MAINVIEW® for DB2 and RxD2 Getting Started

MAINVIEW for DB2 7.2
RxD2 2.1

Component of
SmartDBA System Performance for DB2

Version 7.2

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  - — product version (release number)
  - — license number and password (trial or permanent)
- operating system and environment information
  - — machine type
  - — operating system type, version, and service pack or other maintenance level such as PUT or PTF
  - — system hardware configuration
  - — serial numbers
  - — related software (database, application, and communication) including type, version, and service pack or maintenance level
- sequence of events leading to the problem
- commands and options that you used
- messages received (and the time and date that you received them)
  - — product error messages
  - — messages from the operating system, such as `file system full`
  - — messages from related software

Contents

Chapter 1. Quick Reference Card 1
Where to Start 3
How to Activate Requests 4

Chapter 2. Isolating DB2 Performance Problems 5
Enter MAINVIEW 6
Check DB2 Status and Activity 8
Check Status of All DB2s 9
Current Thread Activity 12
Exceptions Overview 14
Thread Activity for Multiple DB2s 14
Analyze One DB2 15
Check DB2 Status 16
DB2 Topic Index Access 19
Buffer Pools 20
Catalog Access 22
Lock Contention Analysis 23
Page Set Status and I/O Analysis 26
Use Monitors to Isolate Problems 31
Start a Monitor 32
Review Critical Problems 35
Exceptions 36
Warning Overview 37
More Detailed Information 38
Windows-Mode Monitor Views 40
Workload Objective Views 42
Audit Trail 43
Issue DB2 Commands 45
View All DB2 Commands 46

Chapter 3. Monitoring a DB2 Data Sharing Group 47
Define the Group Context 48
Check Current Group Activity 51
Look at Page Set Considerations (I/O / GBP-DEP) 53
Analyze Global Lock Contention 57
Tune Group Buffer Pools 61

Chapter 4. Tuning an Application with Trace 65
Start an Application Trace 66
Specify Options 67
Activate the Trace 72
Review Tips on Tracing Tests 73
Look for Application Problems 75
All Trace Entries (DB2 Accounting Records) 77
Data for One Thread 78
View DB2 Accounting Data 79
View Detail Event Summaries (Detail Trace Only) 82
Another Thread 88
Detail Events 89
Summarized Data for All Threads 91
Application I/O Analysis 92
Viewing Detail Trace Data for Active Threads 93

Print a Trace Report 94
All Data per Traced Thread 95
Other Examples 97

Chapter 5. Analyzing the DB2 Workload 99
Analyze Recent Workload History 100
Thread History Collection 100
Accessing Thread History Data 100
Workload Summaries 101
Workload Analysis from an MVDB2 TLDS 105
Isolating Problems 109
Workload Analysis from MVDB2/DC Active Trace Data Sets 112
Analyze DB2 I/O 115
Run a System I/O Trace 116
Analyze I/O by Page Set 117
Analyze I/O by Application 118
Print Workload Reports 119

Chapter 6. Using RxD2 with MAINVIEW for DB2 123
Improve Performance with SQL Prototyping 124
Start a Trace 125
Test a Statement 126
EXPLAIN a Statement 128
Compare Test Results 130
Print Results 132
Access DB2 Catalog and PLAN_TABLE Information 133
Accessing the RxD2 Primary Option Menu 133
Accessing EXPLAIN for Currently Executing SQL 134
Accessing EXPLAIN from a Trace 136
Accessing Other Catalog Data with Direct Hyperlinks 140
Accessing Specific Objects in the Catalog 142

Chapter 7. Printing Reports 147
Print Online Reports 148
History Traces (Thread Data) 148
All Data per Traced Thread 149
Other Accounting Report Examples 152
Other Detail Trace Report Examples 153
Online Views 154
Print Offline Reports 155
Batch Trace Print 155
Trace Print from a TLDS 156
Trace Print from SMF Records 159
Performance Reporter Reports 160
Data Collector Reports 160
Reports from SMF 160
Reports from DB2 Tables 162

Index 165

About This Book

This tutorial is intended for first-time users of MAINVIEW for DB2 and RxD2. It takes you step-by-step through practice sessions with several fundamental product applications.

Note: You will need appropriate DB2 authorization to execute certain steps.

Conventions Used in This Book

The following syntax notation is used in this tutorial:

- Items you type and keys you press are highlighted with **bold** letters.
- An item in CAPITAL LETTERS must be entered exactly as shown.
- Items in lowercase letters are values you supply.
- A vertical line | separates alternative options; one must be chosen.

The term pop-up refers to an ISPF pop-up display that replaces the original screen image.

Note: Throughout this document, MVDB2 refers to MAINVIEW for DB2 and MVDB2/DC refers to MAINVIEW for DB2 – Data Collector.

Related Reading

This book is included as part of the MAINVIEW library, which documents all your MAINVIEW products and the tasks associated with using these products.

Several books from the DB2 Performance products and DB2 Administration products libraries are also included to help you install the selectable components of MAINVIEW for DB2. These components are also used by other DB2 Performance products provided by BMC Software.

See the “About This Book” section of Volume 1 of the *MAINVIEW for DB2 User Guide* for more information on

- The MAINVIEW library
- The DB2 Performance products and DB2 Administration products libraries
- The MAINVIEW for DB2 Library
- Other recommended reading

A glossary of terms is included in the *Using MAINVIEW* book.

Chapter 1. Quick Reference Card

This chapter contains a quick reference card for your use. You can tear it out and keep it by your terminal if you wish.

It contains

- A brief list of where you should start looking when you want information about a certain topic
- Examples for defining requests

Important

If you are a new user, be sure to go through each of the practice sessions in the rest of this book before using the quick reference card.

Quick Reference Card MAINVIEW for DB2

Where to Start

To See	Start Here
MAINVIEW for DB2	Option D on MAINVIEW Selection Menu, then Option 1 on DB2 Solutions submenu
Multiple DB2s	EZDSSI Easy Menu (standard windows-mode entry point)
One DB2	EZDB2 Easy Menu
Applications analysis	EZDBA Easy Menu
DB2 topic index	EZDTOPIC Easy Menu, or TOPICA, TOPICB, etc.
Tuning wizards	EZDWIZ Easy Menu
All windows-mode views	• MAIN view—organized by category • VIEWS view—list of all views
A full-screen-mode service from windows mode	• Various hyperlinks in views • TRANSFER target product;service Examples: `TRANSFER DB2P DB2;LOG` or `TRANSFER DB2P DB2;EX LOCKD`
A windows-mode view from full-screen mode	• Option V on Primary Option Menu • TRANSFER target MVDB2;view
Status of all DB2s	STDB2 view
Detail status of one DB2	STDB2D view
Current threads	• THDACTV view • USERS (full-screen mode)
Current locks	LOCKD or LOCKU (full-screen mode)
Lock contention analysis	• Lock Analysis tuning wizard (WZLOCK view) • LKEVENT or LKEVSSI views
Data sharing analysis	Data Sharing tuning wizard (WZDSHAR view)
Page set and I/O analysis	EZDPS Easy Menu
Buffer pools	EZDBFRPL Easy Menu
Group buffer pools	• EZDSSI / EZDBFRPL Easy Menus • Data Sharing tuning wizard (WZDSHAR view)
Monitors	EZDB2 / EZDSSI Easy Menus: Monitor section hyperlinks
Exception messages	• ALERTS views • Journal log (chronological), DB2EX (full-screen mode)
Workload objectives	EZDB2 / EZDSSI Easy Menus: Monitor section hyperlinks
Current traces	• EZDB2 Easy Menu: Thread section hyperlink • Option 4 (full-screen mode)
History traces	• EZDB2 Easy Menu: Thread section hyperlink (HTLOGS) • Option 5 (full-screen mode)
Recent workload history	• EZDB2 Easy Menu: Thread section hyperlink (HTLOGS), drilldown • Option 6 (full-screen mode)
DB2 catalog information	Catalog Manager Browse, from EZDB2 Easy Menu or specific object hyperlinks

How to Activate Requests

- **To define requests for automatic startup** (BLKDMRW member in BBPARM):
  - Summary Trace example

```
REQ=ATRAC THRDHIST  TYPE=SUMMARY  TITLE='THREAD HISTORY'  STORAGE=4000K
    LOGTRAC=Y   TRNUMDS=3   TRSWTIME=24:00 TRDSN='Mypfx.Trace.Dsn.V01'
```

  - Detail Trace example

```
REQ=ATRAC DETLABC  DB2PLAN=ABC  TYPE=SQL,SCAN,IO
    STORAGE=4000K  WRAP=Y  TITLE='I/O TRACE OF ABC' GROUPSQL=Y
    TRBUFF=5, TRSIZE=800K
```

  - Monitor example

```
REQ=BPUTL BP0  WMAX=85  I=00:01:00 WLIM=99  LOG=ATWARN
```

  See sample member BLKDMRKY in BBPARM for a description of all the keywords you can use.

- **To define requests to check active thread exceptions** ("runaway queries") or other background exception conditions (DMRBEX00 member in BBPARM):
  - TSO Exception example

```
MSG=DZ0630W,CPUTOT=1000,GPTOT=100000
```

  See sample member DMRBEXBB in BBPARM or "Chapter 3 - Monitors and Exception Detection" in Volume 2 of the *MAINVIEW for DB2 User Guide* for a complete list of all the background monitors.

  To display the active background samplers, you can type **`BG ON`** from the Active Timer Requests application (Option 3).

- **To activate, modify, or purge individual traces,** use the Start Trace panels (ST option from Current Traces (Option 4)).

- **To activate, modify, or purge individual monitors,** use the Start Monitors panels (SM option from Active Timer Requests (Option 3)).

- **To activate a block request with additional monitors or traces manually,** type on any full-screen display:

```
SERV ===> SET
PARM ===> BLK=blkmbrname
```

  where `blkmbrname` is BLKDMRW or a user-created block request member in BBPARM.

- **To purge all existing requests from BLKDMRW manually,** type on any full-screen display:

```
SERV ===> SET
PARM ===> PRG=BLKDMRWP
```

Chapter 2. Isolating DB2 Performance Problems

These scenarios teach you how to navigate easily through the MAINVIEW for DB2 views and displays and use the available facilities. They do not show you every area covered by the product or all of the displays.

In this practice session, you

1. Check status and activity of all DB2s to detect potential problem areas.
2. Analyze a single DB2 to study problem areas in more detail.
3. Use monitors to isolate specific resource- or workload-related problems.
4. Review critical problems, including those just identified by workload monitors.

See the *Using MAINVIEW* manual for a complete description of how to work in both windows mode and full-screen mode.

Note: This practice session takes approximately one hour to complete.

Enter MAINVIEW

If you are new to MAINVIEW, you should get a copy of the document *MAINVIEW Quick Reference* before starting. This document covers the basic things you need to know to use any MAINVIEW product. It also includes some blank lines that should be filled in with your startup options. See *Using MAINVIEW* for more detailed information.

1. Enter MAINVIEW by executing the MAINVIEW CLIST, selecting an ISPF panel option, or logging on to a VTAM session.
2. Go to Option **0.1.1** to specify your CASID, and then return to the MAINVIEW Selection Menu, as shown in Figure 1.

Accessing MAINVIEW for DB2

```
------------------------- MAINVIEW Selection Menu -------------------------
 OPTION  ===>                                              DATE   -- 03/09/26
                                                           TIME   -- 10:47:08
      0    Parameters and Options                          USERID -- BMVDID3
      E    Alerts and Alarms                               MODE   -- ISPF 5.2
      P    PLEX Management (PLEXMGR)
      U    Utilities, Tools, and Messages

   Solutions for:
      A    Automated Operations
      C    CICS
      D    DB2
      I    IMS
      L    Linux
      N    Network Management
      S    Storage Management
      T    Application Management and Performance Tuning
      W    WebSphere and MQSeries
      Z    OS/390, z/OS, and USS

      Enter X to Terminate

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```

Figure 1. MAINVIEW Selection Menu

From this menu and its related set of submenus, you can access any installed MAINVIEW product. Products that work together to provide similar solutions are grouped together in submenus. You also have access to a full set of MAINVIEW functions that work with all of your MAINVIEW products to help you solve your performance problems. (See *Using MAINVIEW* for a description of these functions.)

3. To access the DB2 Solutions submenu, shown in Figure 2 on page 7, select option **D** from the MAINVIEW Selection Menu.

Accessing MAINVIEW for DB2

```
------------------------------ DB2 Solutions ---------------------------------
OPTION  ===>                                                 DATE   -- 2003/05/08
                                                             TIME   -- 12:38:32
   Performance                                               USERID -- BOLLAA2
      1  MVDB2        MAINVIEW for DB2                      MODE   -- ISPF 5.2
      2  SPD          System Performance for DB2

   Application Management and Operations
      V  MVVP         MAINVIEW VistaPoint
      A  AUTOMATION   MAINVIEW AutoOPERATOR
      E  ALERTS       Alert Management

   General Services
      M  MESSAGES     Messages and Codes
      J  JOURNAL      Journal Log
      P  PARMS        Parameters and Options
```

Figure 2. DB2 Solutions Submenu

Note: If you have the full SmartDBA System Performance for DB2 solution installed, you can use option **2** to access its capabilities.

4. To access MAINVIEW for DB2, select option **1** from the DB2 Solutions submenu.

   The Parameter Confirmation panel is displayed, as shown in Figure 3.

Setting Session Parameters

```
BMC Software ------------ Parameter Confirmation ----------- MAINVIEW for DB2
Command  ===>

  Confirm parameters for this session of MainView for DB2:

    Context  ===> ALL        Default context

    Screen   ===> MVDB2      Initial screen

    Mode     ===> WINDOW     Window/Full/FullScreen (Initial Mode)

    Confirm  ===> YES        Yes/No (Show this panel at next session startup)


  Press Enter to continue or press HELP for additional information.
```

Figure 3. MAINVIEW for DB2 Parameter Confirmation Panel

This panel prompts you to confirm the parameters for your MAINVIEW for DB2 session. The first time you sign on, the default parameters are

- A context of all active DB2 subsystems
- An initial screen of MVDB2, which displays an Easy Menu called EZDSSI
- A primary display mode of MAINVIEW windows mode

You can change the parameters for a session by changing the values on this confirmation panel. You can also change the default parameters for future sessions of MAINVIEW for DB2 by selecting option 0.1.D, Parameters–Windows Mode, on the MAINVIEW Selection Menu.

5. To continue with this exercise, change the Mode setting to **FullScreen** and press **Enter** to access the MAINVIEW for DB2 Primary Option Menu, as shown in Figure 4 on page 8.

Check DB2 Status and Activity

Begin by accessing the MAINVIEW for DB2 Primary Option Menu, as shown in Figure 4.

Analyzers
Monitors
Traces

Thread History

Views

DB2 Catalog

DB2 Console

```
BMC Software --------------- PRIMARY OPTION MENU ------- MAINVIEW for DB2 7.2.0
OPTION  ===> V                                            DATE   -- 9/17/02
                                                          TIME   -- 13:45:08
    Managing DB2 Performance:                             USERID -- CIR11
      1  STATUS         - DB2 Status (DB2ST)               MODE   -- ISPF 4.2
      2  ANALYZERS      - Current Status/Activity Displays
      3  MONITORS       - Early Warnings/Recent History (Active Timer Requests)
      4  TRACES         - Current Application Traces
      5  HISTORY TRACES - Historical Trace Data Sets
      6  GRAPH          - Recent Thread History
      7  I/O            - DB2 I/O Analysis
      8  BBI INFO       - BBI Subsystem Information
      V  VIEWS          - Windows Mode (New Facilities)

    DB2 administration:
      RX RxD2 FlexTools

    General Services:
      C  CYCLE SETUP  - Service Refresh Cycle Setup
      L  LOG DISPLAY  - Display Logs
      M  MESSAGES     - Display Messages and Codes
      K  KEYS         - Current PF Key Assignments
      T  TUTORIAL     - Tutorials/News/Getting Started      PF1/13: HELP
      X  EXIT         - Terminate                           PF3/15: EXIT
```

Figure 4. MAINVIEW for DB2 Primary Option Menu

From here, you have direct access to all facilities provided by MAINVIEW for DB2. Most of the options shown here provide direct access to data displays and control panels for managing a single DB2 at a time. You can change the target DB2 directly on almost every screen. Most of these functions operate in full-screen mode. If you want to access the trace facility quickly (options 3 and 4), this can be a good starting place.

However we are first going to investigate the capabilities of the windows-mode views, since they are specially designed to provide an overview of multiple DB2 subsystems at a time, as well as drill-down to details about any single DB2.

Point-and-shoot *hyperlinks* take you from one view to other displays with related information. Sometimes these displays are further windows-mode views; sometimes they are full-screen displays normally accessed through these menu options.

Check Status of All DB2s

To access windows mode and get acquainted with the views available for monitoring multiple DB2s at a time:

1. Press **PF3** to return to the DB2 Solutions Menu and choose option **1** again. This time, select **Windows** mode. This mode of entry is preferred because you have quick access to all DB2s.

   Or, from the Fullscreen Primary Option Menu, select the **VIEWS** option.

   ```
   OPTION ===> V
   ```

   The DB2 SSI Easy Menu (EZDSSI) is displayed, as shown in Figure 5.

Window Information Line ==>

DB2 Overview

```
17SEP2003  16:32:36 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =EZDSSI==========(ALL======*=======)17SEP2003==16:37:22====MVDB2====D====1
                           DB2 SSI Easy Menu
   DB2 Status                                    Thread Activity
 . SSI Status - List DB2s +----------------------+ . Current Threads (Elap)
 . Exceptions             |   Place cursor on    | . Summary by DB2
 > Exception Menu         |    menu item and     | . Thrd Workload History
 > Stats Menu             |     press ENTER      |
                          +----------------------+
   System Resources                              Component Features
 > Locking Menu             Monitors             > DB2 Event Traces
 . Buffer Pools             . In Warning         Catalog Manager Browse:
 > Buffer Pool Menu         . Summary By Area    * Set Profile-Local DB2
 . EDM Pool                 . Active               Tools And Menus
 . RID Pool                 . Workload Objectives  . Set SSI Context
 . Logging                                       > Easy Menu
 . DDF Activity               DB2 System         > MAIN Menu
 . Page Set Status          . DB2 Topic Index    > Tuning Wizard Menu
 . Volume I/Os (SSI)        > Data Sharing Menu  > Data Sharing Wizard
 > Page Set Menu                                 > What's New
                                                 . Return...
```

Figure 5. DB2 SSI Easy Menu (EZDSSI)

2. Look at the fourth line from the top.

   This is the *window information line.* It shows the number of this window (since you may later have several windows open at once), the name of this view (EZDSSI), the current target context (ALL), date, time, and product (MVDB2).

   This view is an example of an Easy Menu that provides hyperlinks to various other views.

   Note: Options prefixed with a period take you directly to data, while options prefixed with a “>” take you to another menu.

   This EZDSSI Easy Menu is designed to be used in Single System Image (SSI) mode to look at multiple target DB2s at one time.

3. Several hyperlinks to other Easy Menus can be used to check out DB2 status, for example:

   - **Stats Menu** provides options to select the many views that show complete DB2 statistics (EZDSTAT). EZDSTAT hyperlinks generally go to tabular views that show one row per DB2 with detail views accessible from there.
   - **Buffer Pool Menu** provides options to show status and statistics for individual buffer pools (and group buffer pools).

   Look at these menus but do not go further now. You can come back here later.

4. To check the status of all DB2s, put your cursor on the **SSI Status - List DB2s** hyperlink and press **Enter**.

   This link takes you to the STDB2 view, as shown in Figure 6, maintaining the default context of ALL, which includes all defined DB2s.

Check Status of All DB2s

```
17SEP2003  16:41:51 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =STDB2============(ALL======*=======)17SEP2003==16:41:51====MVDB2====D====3
 DB2        Act   Comm  Getpg  Lockout Total                Dataset  Dataset  G
 Target     Thrd  Rate   Rate     Rate Excpt Warning Msg     In-Use     Open
 DBOGC         0   0.0    0.0      0.0     0 Connect Fail         0
 DBOHC         0   0.0    0.0      0.0     0 Connect Fail         0
 DB1GC         0   0.0    0.0      0.0     0 Connect Fail         0
 DB1HC         2   0.0    0.1      0.0     0 GBL cont >2%         4       18
 DB2GC         0   0.0    0.0      0.0     1 Connect Fail         0
 DB2HC         5   0.0   11.0      0.0     0 GBL cont >2%        16       37
```

Figure 6. DB2 Activity Overview (STDB2)

With this view, you can quickly gauge how well each of your DB2 subsystems is performing by reviewing and comparing the number of active threads, key activity rates, a total exception count, and the most critical warning condition that exists right now (if any). Notice the “>” sign before the W1 in the information line. This symbol indicates that you can scroll right for more data.

Later you will see how you can move these fields around and set thresholds to customize the view to meet ***your*** monitoring needs exactly (or even create different views for different conditions).

5. Several of the column headers are highlighted, indicating that you can choose a row in that column. From each row, you can hyperlink to a view with more detail (related to that column) for the selected DB2.

   If you see a warning message for one DB2, place the cursor on that message and press **Enter** to see a list of all the warning conditions that are tracked per DB2. If multiple conditions exist at the same time, only the most important is shown in STDB2, and the others are set to YES in this view. Press **PF3** to return to STDB2.

   Note: You can do this hyperlink to see the list even if the warning message field is blank (all the conditions will be set to NO).

6. Hyperlink on the **DB2 Target** field for an active DB2 to see a detail status view.

   You will return here later. Press **PF3** to return to STDB2.

7. Hyperlink on the **Comm Rate** field for an active DB2 to see counts and rates of activity in that DB2, both for the current interval (1 to 15 minutes) and for the total session data since DB2 startup.

Interval and Session Counts

```
17SEP2003  16:37:54 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =STDB2====STRATE==(ALL======DB2HC===)17SEP2003==16:37:52====MVDB2====D====1
               Interval    Session  Interval   Session  Interval   Session    I
                    Qty        Qty      Rate      Rate   /Thread   /Thread

 Commits.....        16         52       0.0       0.0       2.0       1.1
 Thd Creates.         8         46       0.0       0.0

 Getpages....     18431      30434      38.8       1.2    2303.9     661.6
 Page Updates       209        211       0.4       0.0      26.1       4.6
 Sync I/O....       259        560       0.5       0.0      32.4      12.2
 Prefetch I/O      2153       3502       4.5       0.1     269.1      76.1
 Write I/O...         4          5       0.0       0.0       0.5       0.1
 DatasetOpens        16         45       0.0       0.0       2.0       1.0

 Lockouts....         2          2       0.0       0.0       0.2       0.0
 LockSuspends        21         51       0.0       0.0       2.6       1.1
 GBLLockCont.        36        924       0.1       0.0       4.5      20.1
 Clm/Drn Fls.         0          0       0.0       0.0       0.0       0.0
 DML SQL.....      1196       1700       2.5       0.1     149.5      37.0
 StProcCalls.         0          0       0.0       0.0       0.0       0.0
 StProcFails.         0          0       0.0       0.0       0.0       0.0

 RID Fails...         0          0       0.0       0.0       0.0       0.0
 EDM Loads...         5         10       0.0       0.0       0.6       0.2
 EDM Fails...         0          0       0.0       0.0       0.0       0.0
 Checkpoints.         0          1       0.0       0.0       0.0       0.0

 Prll Groups.         0          0       0.0       0.0       0.0       0.0
 PrllFallback         0          0       0.0       0.0       0.0       0.0
```

Figure 7. Activity Rates (STRATE)

Again, some of these fields are highlighted, indicating that hyperlinks will take you to even more detail.

8. Press **PF3** to return to STDB2.

Current Thread Activity

From the DB2 status overview (STDB2), you can access current thread information:

1. Hyperlink on **ACTV THRD** to view a list of all active threads in the selected DB2, as shown in Figure 8.

All Active Threads

```
17SEP2003  11:59:34 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =THDACTV==========DB2H=====*========17SEP2003==11:59:20====MVDB2====D====3
          DB2  Connect               Elapsed              SQL
 Auth ID  ID   Name      CPU Time     Time       %CPU   Stmts Warn  Locks User
BOLHHH4  DB2H DB2CALL  00:01:22.06 00:08:24.48   2.1       2 No        8 ACTIV
BOLLAA2  DB2H DB2CALL  00:01:07.16 00:05:58.88   0.8   23251 No       15 ACTIV
BOLLAA2  DB2H DB2CALL  00:00:00.00 00:00:02.11   0.0       2 No        4 SWAPP
DMRC     DB2H DB2CALL  00:00:32.12 05:40:25.95   0.0       0 No        0 BBI M
```

Figure 8. All Active Threads for One DB2 (THDACTV)

2. Type **SORT D** on the COMMAND line, move your cursor to the **SQL Stmts** header, and press **Enter** to sort the threads by the number of SQL statements executed (the usual sort order is descending by elapsed time).

3. Hyperlink on one thread by placing your cursor in the **AUTH ID** column to see a detail display for that thread, as shown in Figure 9.

Detail User

Expand to Locks Held =>
SQL Detail =>

Expand to SQL Detail =>

SQL Statement

```
 BMC Software --------------   DETAIL USER STATUS    -------------  RX AVAILABLE
 SERV ==> DUSER           INPUT    15:01:07  INTVL=> 3  LOG=> N  TGT==> DB2G
 PARM ==> BOLHHH4                              ROW     1 OF    80 SCROLL=> CSR
 EXPAND:  MON(USER), UTRAC, ST(START TRACE), LOCKE, EXPLAIN, PT, CICSE, CMRTASK
          ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, SPAS, DDF
 CURRENT........11:07:13.53 PLAN..............DSNESPRR TYPE..............ALLIED
 START..........10:58:49.39 AUTHID.............BOLHHH4 CONNECT..........TSO/TSO
 ELAPSED...........00:08:24 ORIG PRIM AUTH.....BOLHHH4 CORR ID.....BOLHHH4
 STATUS..............IN-DB2 COMMITS..................0 ROLLBACKS..............0
 ------------------------------------------------------------------------------
 RUNTIME ANALYSIS   IN DB2     IN APPL.      TOTAL      %IN DB2(=)     TOTAL(*)
 ----------------   --------   --------   --------     0 ...25...50...75..100%
 ELAPSED TIME       00:08:23     718 ms   00:08:24     | ==================* |
 CPU TIME           00:01:22     123 ms   00:01:22     | ===                 |
 DB2 WAIT TIME         20 s                            | <                   |
 - - - - - - ACTIVITY - - - - - -      - - - - - KEY INDICATORS  - - - - - - -
 TOTAL SQL.......................2      SQL: DYNAMIC(PREPARE)=     1
 GETPAGES..................416,803     I/O RSP: SYNC=    45 ms, ASYNC=   107 ms
 SYNC READS (PRLL=00) .........147
 PREFETCH PAGES READ.........1,051
 UPDATES/COMMIT................0.0
 BFR HIT RATIOS:...VP=100%,HP=100%
- - - - - - - - - - - - - -SQL STATEMENT ANALYSIS - - - - - - - - - - - - - - -
STATEMENT #:    193                  STATEMENT TYPE:  OPEN
ACTIVE IN DB2               CPU TIME: 1,897 ms     ELAPSED TIME: 00:01:06
Package/DBRM: DSNESM68  (DYNAMIC)           PLAN ISOLATION LEVEL: RR
PROCEDURE/UDF/TRIGGER:  DSN8SPAS_TEST
SELECT * FROM LONG_SQL ;
```

Figure 9. Detail User Status Display (DUSER)—Base Section

This display shows all available accounting detail information about that thread. The most critical data is summarized in the base section, including key indicators of failures or potential problems. You can scroll down, use the expand buttons, or point-and-shoot to view complete detail data. Also, the DB2 thread cancel command can be invoked with a CANCEL parameter if you have the proper authorization.

4. The full text of the current SQL statement being executed is available near the bottom of this base section.

   If your window size is too small to show the full text, position the cursor on the first text line and scroll down with **PF8**.

   Notice that this section also includes the current package/DBRM name, the amount of time this SQL statement has been active, and the last page accessed.

5. Tab to the **SQLCOUNTS** button or to the **TOTAL SQL** line and press **Enter** to view a breakdown of all SQL executed by this thread.

6. Press **PF3** once to return to the DUSER base section.

7. If this is an active IMS or CICS thread and if MAINVIEW for IMS or MAINVIEW for CICS is installed, the detail display will include an expand button to expand directly to that product:

   - MAINVIEW for CICS: TASKXPND display for this CICS transaction
   - MAINVIEW for IMS: DREGN display for the region processing this IMS transaction

   Press **PF3** once to return to DUSER.

8. There are many other sections of detail data with which you will get acquainted over time. For example, if you are concerned about locking, you could choose the **LOCKE** expand button to see all the locks held (or waited on!) by this thread and any threads in contention with it.

9. Press **PF3** again to return to THDACTV. There are several other hyperlinks that can be useful in analyzing a thread:

   – **%CPU** is highlighted if APPTUNE is installed. You can then hyperlink on this column to immediately access the detailed SQL statement activity collected for the plan of the selected thread.

   – Hyperlink on **User Status** to see a subset of the DUSER information in THDDETL. Staying in windows mode may be valuable if you need to “freeze” the threads to look at several at the same point in time.

   – Hyperlink on **Activity** when it shows a currently active SQL statement. This hyperlink takes you to the Data Collector Explain, which includes Plan_Table information, catalog object data, and SQL recommendations.

10. Press **PF3** several times to return to EZDSSI.

Exceptions Overview

Exception Conditions

Another way to check for exception conditions in any of your DB2s quickly is to choose the **Exceptions** hyperlink on EZDSSI to bring up the view STEXC, as shown in Figure 10.

```
17SEP2003  16:52:20 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =STEXC============(ALL======*=======)17SEP2003==16:50:58====MVDB2====D====4
 DB2      Warning  System     User
 Target   Monitors Exceptions Exceptions Warning Msg
 DB1GC           0          0          0 Connect Fail
 DB1HC           0          0          0 GBL cont >2%
 DB2GC           0          0          0 Connect Fail
 DB2HC           1          0          0 GBL cont >2%
```

Figure 10. Exception Conditions (STEXC)

This view identifies immediately whether or not any exceptions have been detected, and shows what kind they are. Hyperlinks lead to additional details.

Warning Monitors show conditions that have been detected by timer-driven sampling monitors defined with warning thresholds. Typically, a predefined group of monitors is started automatically and it is always active. A later section provides more information on monitors.

System Exceptions are conditions that are detected by a background sampler and are not governed by a threshold; for example, a problem with log archiving.

User Exceptions are thread-related conditions detected by a background sampler. Threshold conditions can be defined per attach type; for example, IMS, CICS, or batch.

The first three types generate warning messages that can be viewed while active, tracked historically in the journal log, or fed into an automated operator product like MAINVIEW AutoOPERATOR.

Warning Msg shows the most important of several conditions that are checked per interval, and on request, as part of the total DB2 status and statistics data collection for windows-mode views. These conditions may also be identified by one of the other exception samplers.

1. If you have a non-zero value for any of these counts, follow the hyperlinks to see further details.
2. When finished, press **PF3** as needed to return to EZDSSI.

Thread Activity for Multiple DB2s

From EZDSSI, you can choose hyperlinks to view thread activity across multiple DB2s:

1. Hyperlink on **Current Threads** to see all active threads, identified by the DB2 they are running in.
2. Hyperlink on **Summary by DB2** to see a summary of threads for each DB2; then hyperlink on **one row** to view a list of threads for just that DB2.

Analyze One DB2

One DB2

Two ways are available to drill down to a specific DB2. For the purposes of this exercise, use the second method:

- Select any view from the DB2 SSI Easy Menu (EZDSSI). From the list of available DB2 targets, you can hyperlink to another view with more information about the selected DB2.
- From EZDSSI, choose the **Easy Menu** hyperlink to access an Easy Menu designed to analyze one DB2 at a time, EZDB2, as shown in Figure 11. This method selects one DB2 from the context of ALL. (If you choose the **SSI Status** hyperlink, the STDB2 view provides a drill down on the target to STDB2D, and from there to EZDB2.)

```
17SEP2003  12:41:15 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =EZDB2=============DB2HC====*========17SEP2003==12:41:14====MVDB2====D====1
                                DB2 Easy Menu
           DB2 Target --->  DB2HC
   DB2 Status                                     Thread Activity
 . DB2 Status Summary     +----------------------+ . Current Threads (Elap)
 . Current Exceptions     |   Place cursor on    | > Active Thread Menu
 > Exception Menu         |    menu item and     | . Thrd Workload History
 . Activity Rates         |     press ENTER      | . Current Traces
 > Stats Menu             +----------------------+ . Graphic THRDHIST
   System Resources                               Component Features
 > Locking Menu             Monitors             > DB2 Event Traces
 . Buffer Pools             . In Warning           . MVDB2/DC Admin/Archive
 . EDM Pool                 . Summary By Area      * CATALOG MANAGER Browse
 . Dynamic SQL Cache        . Active               . Pool Advisor
 . RID Pool                 . Workload Objectives    Tools And Menus
 . Logging                  . Start/Stop/Modify    . Set Target Context
 . DDF Connections                                 > SSI Easy Menu
 . Page Set Status            DB2 System          > DBA Easy Menu
 . Volume I/O Summary       > ZPARM Menu          > Fast Menu
 > Page Set Menu            > DB2 Topic Index     > MAIN Menu
 > Tuning Wizards           > FullScreen Menu     > What's New
                                                  . Return...
```

Figure 11. DB2 Easy Menu (EZDB2)

To select the target DB2 you want to analyze:

1. Hyperlink on **Set Target Context** to see a list of targets; then place your cursor in the **Target** column and press **Enter** to hyperlink to a different target.

   Note: If you already know the DB2 target you want, simply type **`CON target`** on the COMMAND line.

2. Notice in the **Tools And Menus** section, there are hyperlinks to several other Easy Menus.

Check DB2 Status

To check the status of the target DB2:

1. Hyperlink on **DB2 Status Summary**.

   This link takes you to the STDB2 view, as shown in Figure 6 on page 10, but only the one DB2 is displayed.

2. Now you may want to review recent history.

   Type **`TIME * * 2H`** to see the last 2 hours by 15-minute intervals. Type **`INCLUDE TIME`** to see the times (the Intvl Time column is added to the view), as shown in Figure 12.

Review History

```
17SEP2003  16:57:55 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =STDB2=============DB2HC====*========17SEP2003==16:57:54====MVDB2====D====1
 DB2       Intvl  Act   Comm  Getpg  Lockout Total                Dataset  Data
 Target     Time  Thrd  Rate   Rate     Rate Excpt Warning Msg     In-Use     0
 DB2HC         5   0.0    4.7      0.0     0 GBL cont >2%         4       63
```

Figure 12. DB2 Activity Overview (STDB2)

   You can hyperlink on a time period for further analysis if desired. (Don't do it now though.)

3. Reset to current time with **`TIME * * 1I`** and then **`EXCLUDE TIME`**.

4. Hyperlink on **DB2 Target** to see a detail status view, as shown in Figure 13 on page 17.

   Note: You can also access the STDB2D view by selecting one DB2 from STDB2 in SSI mode.

Detail Status View

```
17SEP2003  16:58:31 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =STDB2====STDB2D===DB2HC====*========17SEP2003==16:57:54====MVDB2====D====1
  DB2 Status
  > EZDB2       .STDB2DS              >EZDSTATD   .Threads    .Threads     .Thd
                Connect   Active      In DB2      Queued      Suspended    CPU%
  TSO........         1        1           0           0              0     0.0

  Batch......         4        4           2           0              1    32.0
  -CAF.......         4        4           2           0              1    32.0
  -Utility...         0        0           0           0              0     0.0

  IMS........         0        0           0           0              0     0.0
  CICS.......         0        0           0           0              0     0.0
  DBAT.......         0        0           0           0              0     0.0
  SPAS.......         9        0           0           0              0     0.0
  RRSAF......         0        0           0           0              0     0.0
  *Total*....        14        5           2           0              1    32.0
   Actv S-Proc                 2           2

                           0...50.100              0...50.100
  GBL cont >2%  EDM Pool               Total CPU%  *****

  BP Rates:..   Getpage      4.7      Reads            0      Writes         0.0
  Locking:...   Suspend        0      Deadlocks        0      Timeouts         0
  Exceptions:   Monitor        0      System           0      User             0
  Data Sets:.   Open          63      Open HWM        63      In-use           4
  Parallel:..   Maximum        0      Groups           0      Fallback         0
  STOPROCS:..   Calls          0      Abends           0      Timeouts         0
  Group BP:..   Reads          2      Writes           2      Failures         2
  Paging:....   DB2          0.0      System         0.0
  DB2 Start:.   Date   17SEP2003      Time      09:19:46      Traces
```

Figure 13. DB2 Status Detail—Interval (STDB2D)

This view shows an overview of current thread activity per attach type as well as key indicators of recent performance. There are several hyperlinks at the top of the view, in addition to hyperlinks to threads of different connect types in the middle of the view, and others in the key indicators shown at the bottom of the view.

5. Use the **.STDB2DS** hyperlink at the top of the view to see totals since DB2 startup instead of current interval values in the key indicator fields.

6. The **>EZDSTATD** option takes you to the DB2 Stats Detail Easy Menu.

   This Easy Menu is very similar to the DB2 Status Easy Menu, EZDSTAT, that you saw earlier, but the hyperlinks here take you directly to all the detailed statistics views for this DB2.

7. Hyperlink on **SQL Counts** to see STSQLD as an example of these detailed statistics views, as shown in Figure 14 on page 18.

Detailed View

```
17SEP2003  17:01:51 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =STDB2====STSQLD===DB2HC====*========17SEP2003==16:57:54====MVDB2====D====1
                            Interval   Session
 Data Manipulation Language
  SELECT.................        0         0
  INSERT.................        0         0
  UPDATE.................        2         6
  DELETE.................        0         0
  DESCRIBE...............        0         0
  PREPARE................       12       205
  OPEN...................       10       199
  FETCH..................      150     46998
  CLOSE..................        9       197
 Data Definition Language..
  CREATE TABLE...........        0         0
         INDEX...........        0         0
```

Figure 14. SQL Counts Detail (STSQLD)

8. Press **PF3** to return to EZDSTATD.

   You may want to browse a few other detail views.

9. Press **PF3** to return to STDB2D.

10. Hyperlink on **TSO** to see a tabular view of current TSO users.

11. We have stepped through several status views now. However, some information is not available in windows mode. Examples are information about CICS connections, DB2 logging, DSNZPARM values, and so forth.

    To access these displays, simply press **PF3** to return to the Primary Option Menu, or you can use one of the following quick paths:

    - From EZDB2, choose **FullScreen Menu** to hyperlink into full-screen mode.
    - Use the transfer command at any point to access the full-screen DB2 Status display DB2ST. This is similar to STDB2D, but it provides point-and-shoot to most full-screen displays, such as CICSC (to see CICS connections), ZPARM, and so forth.

      ```
      TRANSFER target DB2;EX DB2ST
      ```

      You can also use the transfer command to access other MAINVIEW products.

12. Return to EZDB2 and choose **Exception Menu**.

    Besides access to the exception displays that you've seen before, the Exception Menu also has a hyperlink to the MAINVIEW ALERTS view. This view consolidates monitor exceptions and those produced by alarms defined in MV ALARM. There are also hyperlinks to the Alerts Menu and to MV ALARM.

13. Press **PF3** to return to EZDB2 again.

DB2 Topic Index Access

Instead of always using the menu navigation, you can quickly find the views you want through topic index views.

1. In EZDB2, hyperlink on **DB2 Topic Index** to access the DB2 Topic Index menu. This menu provides alphabetic access to the defined topics.
2. Press **PF3** to return to EZDB2.
3. Think of a DB2 performance issue you might want to investigate. For this walkthrough, let's choose "data set open/close activity". For the quickest access, you can now type **TOPICD** on the COMMAND line to access a list of DB2 topics starting with the letter D, as shown in Figure 15. (This can be done in any MVDB2 view.)

Quickly Find Information about DB2 Topics

```
15OCT2003  17:19:48 ------ MAINVIEW WINDOW INTERFACE(V4.1.09)MVDB2------------
COMMAND  ===>                                              SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =EZDTOPIC=TOPICD==(ALL======*=======)15OCT2003==17:19:40====MVDB2====D====1

DB2 Topic Index - D          View     SSI Monitor ZPARM    Acctg  Trace
Data Base Descriptors (DBD) STEDMPD   Y   -       -        -      -
Data Capture(IFI)           STCHKPD   Y   -       ZPSYSD   -      -
Data Definition Control      -        -   -       ZPDDLCTD -      -
Data Manager Crit.Threshold BFRPL     Y   BPUTL   -        -      -
Data Sets
 Activity                   STDSAD    Y   -       -        -      -
 Current Open               STDSAD    Y   DSOPN   -        -      -
 Deferred (Pseudo) Close    STDSAD    Y   -       ZPDSETD  -      -
 Management                  -        -   -       ZPDSETD  -      -
 Migrations                 STDSAD    Y   MIGDS   -        -      -
 Migrations - by BPool      BFRPL     Y   -       -        -      -
 Open Requests              STDSAD    Y   DSOPR   -        -     EV/DTL
 Opens - by Buffer Pool     BFRPL     Y   -       -        -      -
 Recall Timeouts            STDSAD    Y   RTO     ZPDSETD  -      -
 Recall Timeouts-by Bpool   BFRPLD    Y   RTO     ZPDSETD  -      -
 Utilization                STDB2D    -   DSUTL   ZPDSETD  -      -
Data Sharing                WZDSHAR   Y   -       ZPDSHRD  -      -
 Castout Definitions         -        -   -       ZPBFMGRD -      -
 GBP Data-Group             STGBFRPD  Y   -       -        -      -
 Locking                    STGBLLKD  Y   -       ZPDSHRD  -      -
Data Space - Buffer Pool    BFRPL     Y   -       -        -      -
Data Space - EDM Pool       STEDMPD   Y   EDMDS   -        -      -
Data Space - SQL Cache      STCACHED  Y   -       ZPTHDD   -      -
DBAS CPU                    STDBSYSD  Y   -       -        -      -
DB2 Definitions              -        -   -       ZPDB2D   -      -
DB2 Statistics              EZDSTATD  Y   -       -        -      -
DB2 Status                  STDB2D    Y   -       -        -      -
DB2 System Definitions       -        -   -       ZPSYSD   -      -

. Link to next page
```

Figure 15. DB2 Topic Index View

4. Now browse through the list of topics starting with the letter, D, until you find **Data Sets**. There are several entries under this topic, including several for open/close activity.
5. The first hyperlink column is usually the one you want to take when looking at a single DB2, but you can also access similar SSI views, related monitors and ZPARMs, and identify relevant trace data.
6. Hyperlink on **STDSAD** to see the view of that name. It will show you the statistics you want to see.

Buffer Pools

To analyze buffer pools for the target DB2:

1. From EZDB2, hyperlink on **Buffer Pools** to see a list of all defined pools with allocated space, utilization, and getpage rates, as shown in Figure 16.

All Defined Pools

```
17SEP2003  17:04:18 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =BFRPL============DB2HC====*========17SEP2003==17:04:18====MVDB2====D====9
 Pool    DB2      Vpool Vpool  Hpool  Hpool  Getpg  Get-    %     % Active
 Name    Target    Size Alloc   Size  Alloc   /sec  pages  Actv 0.....50....100
 BP0     DB2HC      200   200      0         143.2  37236     0
 BP1     DB2HC       25             0           0.0      0     0
 BP2     DB2HC       25            30           0.0      0     0
 BP4     DB2HC       21             0           0.0      0     0
 BP5     DB2HC       30             0           0.0      0     0
 BP9     DB2HC       20             0           0.0      0     0
 BP11    DB2HC      400             0           0.0      0     0
 BP32K   DB2HC       20             0           0.0      0     0
 BP32K9 DB2HC        20             0           0.0      0     0
```

Figure 16. Buffer Pool Statistics—SSI (BFRPL)

2. Hyperlink on **Pool Name** to see all status and statistics for one pool.

   Both interval and session counts are shown, as shown in Figure 17.

Statistics for One Pool

```
17SEP2003  17:05:05 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =BFRPL====BFRPLD===DB2HC====*========17SEP2003==17:04:18====MVDB2====D====1

 Pool Name.........................      BP0
 VP Size...........................      200
 Hiperpool Size....................        0
 Virtual Pool Sequential Threshold       80
 Hiperpool Sequential Threshold...       80
 Deferred Write Threshold.........       50
 Vertical Write Threshold.........       10
 Castout Attribute Y/N............        Y
 Parallel Sequential Threshold....       50
 Assisting Parallel Threshold.....        0

                                  Interval   Session
 Virtual Pool Allocation..........
   Buffers Allocated..............                200
   Current Active Buffers.........                  1
   Expansions/contractions........        0         0
   No Buffer - Pool Full..........        0         0
   Expansion Fail.................        0         0
 Hiperpool Allocation.............
   Expanded Storage Buffers.......                  0
   Buffers Allocated..............                  0
   Expansions/Contractions........        0         0
 Virtual Pool Read Statistics.....
   Getpages.......................    37236    135607
   Sequential Getpages............    36910    128765
   Sync I/O.......................      104      1657
   Sequential Sync I/O............        0       289
```

Figure 17. Local Buffer Pool Statistics Detail (BFRPLD)

3. Scroll down with **PF8** to see all the data. Press **PF3** to return to BFRPL.

4. Hyperlink on **Getpg/sec** to see current hit ratios per pool (BFRPLH); then hyperlink on **Pool Name** to see both current and session ratios (BFRPLHD) for one pool, as shown in Figure 18.

Hit Ratios

```
17SEP2003  17:07:12 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =BFRPL====BFRPLHD==DB2HC====*========17SEP2003==17:04:18====MVDB2====D====1
 Pool Name..................... BP0

                                Interval   Session
 Hit Ratios.....................
  VPOOL Hit Ratio % with P/F...    17.51     18.55
  VPOOL Hit Ratio % without P/F    92.64     81.70
  GBP Hit Ratio %..............     0.00     18.92
 Activity per Second...........
  Getpages.....................   143.20      4.87
  Page Updates.................    29.78      0.61
  Sync I/O.....................     0.40      0.06
  Prefetch I/O.................    15.51      0.51
  Write I/O....................     0.80      0.02
  Data Set Opens...............     0.00      0.00
```

Figure 18. Buffer Pool Rates Detail (BFRPLHD)

5. Press **PF3** to return to EZDB2.

   Group buffer pools are discussed later in the data sharing section (see "Tune Group Buffer Pools" on page 61).

Catalog Access

MVDB2 also provides a catalog browse facility with hyperlinks to the CATALOG MANAGER product. If you are licensed for the full product, all of its functions are available directly from MVDB2.

1. From EZDB2, hyperlink on **CATALOG MANAGER Browse** to access the Catalog Browser Primary Menu, as shown in Figure 19.

Look at Catalog Objects

```
DB2K-  -------------  Catalog Browser 7.2.01   Primary Menu  -----------------
Command ===>



Enter object type and qualifier for an object list


Object type . . .
                   DB Database   TS Tablespace   PL Plan      ST Strings
                   SG Stogroup   SU SysPrivUser  AL Alias     LO Locations
                   TB Table      SY Synonym      US User      CK CheckConst
                   VW View       PG Package      CO Column    PR Procedures
                   IX Index      CI Collection   DM DBRM

Qualifier . . . .

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                       as an unpublished licensed work.
                            All rights reserved.
```

Figure 19. Catalog Browser Primary Menu

   This menu allows you to browse most catalog objects.

2. Press **PF1** for help to see a complete list of objects.
3. Tab to the **object type** selections and type **DB** to see a list of data bases.
4. You now see the object list display of all data bases. Enter a line command of either **S** or **D** next to one data base to see the complete catalog row data for that data base.
5. Press **PF3** to return to the database list. Now enter the **TS** line command to see a list of all the table spaces in the selected database.
6. For help on available actions, type **COMMAND**. For help on a message you received, type **TSO BMCMSG*msgid***.

Lock Contention Analysis

Although locking problems must usually be resolved at the application level, the first indication of problems—and the simplest identification of the applications and resources involved—can best be seen at the system level. To use the options in the Lockouts section of EZDB2 to look at locking problems in one DB2 (without data sharing):

1. If you aren't sure whether or not you are having much lock contention, you may want to review the lockout and suspension counts and rates first in the STRATE view (hyperlink on **Activity Rates**).

   A certain number of lock suspensions (and even an occasional timeout or deadlock) is to be expected in an active DB2 system. More frequent lockout conditions (either timeouts or deadlocks) may be a cause for concern, since the SQL statements involved are terminated.

2. You can hyperlink to see a list of the last 100 timeouts and deadlocks either from the **Lockouts** field in STRATE, or from **Lockout Events** on EZDB2.

   Both go to the view LKEVENT, as shown in Figure 20.

Timeouts and Deadlocks

```
17SEP2003  17:20:11 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKEVENT==========DB2HC====*========17SEP2003==17:20:10====MVDB2====D====5
 Date / Time    Lockout   Victim   Victim   Victim   Victim Victim        Nr.
 -------------- Type      Plan     AuthID   Connect  CType  Corr ID       Res.
 17SEP-16:58:56 DEADLOCK  AUDIT    BBLLAT5  TSO      TSO    BBLLAT5          2
 17SEP-16:58:45 TIMEOUT   PAYROLL  DMRDLK3  BATCH    BATCH  DMRDLK3          1
 17SEP-16:42:34 TIMEOUT   PAYROLL  DMRTMO3  BATCH    BATCH  DMRTMO3          1
 17SEP-16:37:33 DEADLOCK  AUDIT    BBLLAT5  TSO      TSO    BBLLAT5          2
 17SEP-16:36:53 TIMEOUT   RXDB2    AXCNM11  DB2CALL  CAF    AXCNM11          1
```

Figure 20. Lockout Events (LKEVENT)

   This view shows a chronological list of up to 100 lockout events that have occurred since DB2 startup, sorted with the most current at the top of the screen.

3. Type **SORT** and tab to the **Victim Plan** column to sort these lockout events by plan name to identify the applications for which SQL requests were terminated.

4. Hyperlink on the **Date/Time** field for an event (preferably a deadlock that involves multiple resources).

   The first view shows the resources involved and holder (blocker) and waiter plans.

5. Scroll right to see additional details for both resources at once, or hyperlink on the **Res Seq** field to see all the available details for this conflict.

6. Press **PF3** to return to EZDB2.

   Although you may have analyzed lockout conditions one at a time like this before, the windows-mode views provide additional analysis capabilities. They are available through the other three hyperlinks in the lockouts section of EZDB2.

7. Hyperlink on **Resource Summary** to do an analysis of the resources involved in timeouts or deadlocks, as shown in Figure 21.

Resources Involved

```
17SEP2003  17:21:09 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===========DB2HC====*========17SEP2003==17:21:09====MVDB2====D====2
 --Resource Name--  Total           % Total                          Global
 Database Object    Conflicts       0...50..100   PAGE   ROW INDEX  Conflicts
 DSN8D51A DSN8S51E          5  71.4 ********         5     0     0          2
 DSN8D51A DSN8S51P          2  28.6 ***              0     2     0          2
```

Figure 21. Lockout Resource Summary (LKRESZ)

The first view, LKRESZ, summarizes all conflicts by resource name, usually database and table space. Note that a deadlock with three resources and participants will result in three conflicts, not one, for the purposes of this analysis. With this view, you can easily identify those table spaces involved in the most contention.

8. Hyperlink on a **resource name** showing one or more conflicts to see a breakdown of these conflicts by specific resource, down to a page or row level (LKRESNRZ).

   With this view, hot spots in your tables are immediately visible, as shown in Figure 22.

See Hot Spots in Tables

```
17SEP2003  17:22:35 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===LKRESNRZ=DB2HC====*========17SEP2003==17:22:35====MVDB2====D====1
 --Resource Name-- Resource   Resource  Total           % Total     Global
 Database Object   Number     Type      Conflicts       0...50..100 Conflicts
 DSN8D51A DSN8S51E 0000001200 DATAPAGE          5  71.4 ********            2
```

Figure 22. Lockout Resource Number Summary (LKRESNRZ)

9. Hyperlink on either the **resource name** or the **resource number** to view a list of each lockout event that involved this resource (LKRESD), as shown in Figure 23.

   The events are initially sorted in descending sequence by time, but the SORT command can be used to sort by any column. (If you have forgotten how, type **HELP SORT** on the COMMAND line.) This allows you to identify the applications (blocker planname, waiter planname) and users (blocker/waiter Corr ID, Connection, Victim Auth ID) involved quickly.

Each Event for This Resource

```
17SEP2003  17:24:34 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===LKRESD===DB2HC====*========17SEP2003==17:24:34====MVDB2====D====5
 --Resource Name-- Resource   Resource   Time     Lockout  Blocker  Waiter   Gbl
 Database Object   Number     Type     -------- Type     PlanName PlanName Con
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:58:56 DEADLOCK PAYROLL  AUDIT    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:58:45 TIMEOUT  AUDIT    PAYROLL
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:42:34 TIMEOUT  AUDIT    PAYROLL
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:37:33 DEADLOCK PAYROLL  AUDIT    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:36:53 TIMEOUT  RXDB2    RXDB2
```

Figure 23. Lockout Resource Conflict Detail (LKRESD)

Although the solution to locking problems may involve application or table redesign, at least you now know where the problems lie.

10. Press **PF3** until you return to EZDB2 and hyperlink on **Connection Summary** if you suspect that the problem may lie in application scheduling, where applications with incompatible lock usage are running concurrently, as shown in Figure 24.

Application Scheduling Problems

```
17SEP2003  17:38:42 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =LKCONZ===========DB2HC====*========17SEP2003==17:38:41====MVDB2====D====1
 DB2      Victim    Victim   Blocker   Timeouts Deadlocks        % Lockouts
 Target   ConnType  Connect  Connect                            0....50..100
 DB2HC    TSO       TSO      BATCH            0         2   40.0 *****
 DB2HC    BATCH     BATCH    TSO              2         0   40.0 *****
 DB2HC    CAF       DB2CALL  CAF              1         0   20.0 ***
```

Figure 24. Lockout Connection Summary (LKCONZ)

The view LKCONZ summarizes the conflict data to identify, for example, whether batch jobs or utilities are blocking critical CICS or IMS transactions. As in the resource summaries, hyperlinks lead to lists of the exact events with time stamps, so that the critical time periods can be seen at a glance.

11. Press **PF3** until you return to EZDB2 and hyperlink on **Blocker/Waiter Summary** in order to identify incompatible applications that are frequently blocking each other, as shown in Figure 25.

Incompatible Applications

```
17SEP2003  17:40:24 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKBWZ=============DB2HC====*========17SEP2003==17:40:24====MVDB2====D====1
 Blocker  Waiter    Timeout Deadlock        % Conflicts    Global  Participant
 PlanName PlanName  Involv.  Invovl.   .... 0....50...100  Confl.  -Only Count
 AUDIT    PAYROLL         2        0   40.0 *****                0            0
 PAYROLL  AUDIT           0        2   40.0 *****                0            0
 RXDB2    RXDB2           1        0   20.0 ***                  0            0
```

Figure 25. Lockout Blocker/Waiter Summary (LKBWZ)

The view LKBWZ summarizes the conflict data by blocker and waiter plans, so that you can quickly see which applications are causing the most conflicts. The hyperlinks again show all of the lockout events where the selected plan was involved.

12. Press **PF3** until you return to EZDB2.

13. To see current contention, hyperlink to the **Fast Menu** (on the right under Tools And Menus).

    In the Lock Activity section, there are two valuable options:

    - Hyperlink on **User Contention** to see a list of active threads with lock counts (LOCKU). Holding and waiting threads in current conflicts are identified.
    - Hyperlink on **DB/TS Contention** to see a list of resources in contention, showing the lock owner and waiters (LOCKD).

    From both of these displays, you can hyperlink on one conflict to see additional details. The LOCKE display shows a thread with all locked resources and identifies waiter threads per resource.

    Note: LOCKU is also accessible through hyperlinks in several thread views (THDxxx).

Page Set Status and I/O Analysis

The tuning of physical I/O and page set usage in the buffer pools is a critical success factor in DB2. DB2 itself uses many techniques to reduce or defer I/O, but the setup, from DASD volumes to buffer pool allocation and thresholds, all plays a part.

1. To look at data object issues with the focus still on a single DB2, begin by accessing the DB2 Page Set Easy Menu, **EZDPS**, as shown in Figure 26.

   Note: MVDB2 collects these page set statistics with low overhead from DB2 control blocks.

Access Page Set Information

```
04JUN2003  15:23:03 ------ MAINVIEW WINDOW INTERFACE(V4.1.07)MVDB2-------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =EZDPS=============DB2K=====*========04JUN2003==15:23:02====MVDB2====D====1
                           DB2 Page Set Menu
  Page Set Information                              I/O by Page Set (SSI)
. Status                +----------------------+ . Total I/Os - Session
. Cache Statistics      |   Place Cursor On    | . Total I/Os - Interval
. List Page Sets (/DB2) |    Menu Item And     | . Sync I/Os - Session
. List Page Sets (SSI)  |     Press ENTER      | . Sync I/Os - Interval
. GBP-Dependent Status  +----------------------+ . Async I/Os - Session
                                                 . Async I/Os - Interval
  Summaries                                        Catalog Manager
. By Volume (SSI)       . Set DB2 Subsystem      . Database List
. By Volume (/DB2)          (Context)            . TableSpace List
. By Buffer Pool                                 . IndexSpace List
. By Data Base
. By Object                                       . Return...
```

Figure 26. Page Set Easy Menu (EZDPS)

2. The first thing to review is simply the status of all open page sets. Hyperlink on **Page Set Status** to see a list sorted by object name (database, table space, partition), as shown in Figure 27.

Sort by Object Name

```
17SEP2003  16:11:08 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =PSSTAT============DB2H=====*========17SEP2003==16:11:08====MVDB2========77
 ------Page Set------- Bfrpl                     %       First   Defr      GBP
 Database Object   Prt  ID    Ty Users Size(K)  Used EXT Volume  WrtQ  ERR Dep
 DB2HWORK DSN4K01  001 BP00   TS     0    7440  99.4   3 BAB310     0   N
 DSNDB01  DBD01    001 BP00   TS     0    1440 100.0   1 BAB310     1   N
 DSNDB01  DSNLLX01 001 BP00   IX     0     288  66.7   1 BAB310     0   N
 DSNDB01  DSNLLX02 001 BP00   IX     0     240  80.0   1 BAB312     0   N
 DSNDB01  DSNLUX01 001 BP00   IX     0      48  33.3   1 BAB320     0   N
 DSNDB01  DSNLUX02 001 BP00   IX     0      48  33.3   1 BAB320     0   N
 DSNDB01  DSNSCT02 001 BP00   IX     0     144  11.1   1 BAB310     0   N
 DSNDB01  DSNSPT01 001 BP00   IX     0     240  40.0   1 BAB312     0   N
 DSNDB01  DSNSPT02 001 BP00   IX     0     432  44.4   1 BAB325     0   N
 DSNDB01  SCT02    001 BP00   TS     0   10080  14.3   1 BAB310     1   N
 DSNDB01  SPT01    001 BP00   TS     0    5760  25.0   1 BAB312     1   N
 DSNDB01  SYSLGRNX 001 BP00   TS     0    1440 100.0   1 BAB310     1   N
 DSNDB01  SYSUTILX 001 BP00   TS     0    1440 100.0   1 BAB320     1   N
 DSNDB06  DSNADH01 001 BP00   IX     0      48  33.3   1 BAB312     0   N
 DSNDB06  DSNAGH01 001 BP00   IX     0      96  16.7   1 BAB314     0   N
 DSNDB06  DSNAPH01 001 BP00   IX     0      96  16.7   1 BAB310     0   N
 DSNDB06  DSNATX01 001 BP00   IX     0     144  11.1   1 BAB312     0   N
 DSNDB06  DSNATX02 001 BP00   IX     0     480  20.0   1 BAB312     0   N
 DSNDB06  DSNATX03 001 BP00   IX     0     432  22.2   1 BAB312     0   N
 DSNDB06  DSNAUH01 001 BP00   IX     0      96  16.7   1 BAB310     0   N
 DSNDB06  DSNDCX01 001 BP00   IX     0    2160  66.7   1 BAB312     0   N
 DSNDB06  DSNDDH01 001 BP00   IX     0      48  33.3   1 BAB310     0   N
 DSNDB06  DSNDDX02 001 BP00   IX     0      48  33.3   1 BAB310     0   N
 DSNDB06  DSNDKX01 001 BP00   IX     0     192  50.0   1 BAB318     0   N
 DSNDB06  DSNDLX01 001 BP00   IX     0      48  33.3   1 BAB312     0   N
 DSNDB06  DSNDPX01 001 BP00   IX     0      96 100.0   1 BAB310     0   N
```

Figure 27. Page Set Status (PSSTAT)

3. Sort on the **EXT** column to identify the data sets with the highest number of extents (a potential performance impact). Type **`SORT D`** and tab to the **EXT** column.

4. If you want to limit the view by selecting only certain page sets, one simple way is to use the WHERE command. It works very much like the SQL WHERE clause. First choose one (or more) column you want to filter the view on. Place the cursor in that column header and press **PF1** to view the field help. Within the help, the element name is identified.

   Now type **`WHERE`** on the COMMAND line. Under Where Condition, type the filters you want in effect.

   For example, to show only those data sets with several extents, type

   `IO_EXT > 5`

   Press **PF3** to return to PSSTAT with the WHERE clause in effect. You can check the filters in effect in any view with the SHOWFILT command.

   Note: Help for any command is available by typing **`HELP commandname`** on the COMMAND line.

   As another example of filtering, to see only catalog tables, type

   `IO_DBTSP = DSNDB06*`

5. Hyperlink on the **Page Set** field to see complete details about the selected page set, including size, volume, buffer pool cache data, and detailed I/O counts and elapsed wait times. You may need to scroll down with **PF8** to see all the data.

6. Press **PF3** to return to PSSTAT.

   Hyperlink on the **Users** column to see the threads currently accessing this page set. Or hyperlink on the **ERR** column to see if a restricted status is in effect for this table space.

7. Press **PF3** to return to EZDB2.

8. One of the most important issues to check periodically is data set placement and volume I/O response times.

   Hyperlink on **Volume I/O Summary** to see the volumes in use for DB2 databases, as shown in Figure 28.

Volumes In Use

```
17SEP2003  11:21:48 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSVOLSZ==========DB2H=====*========17SEP2003==11:21:48====MVDB2========11
         DB2       Nr.     Sync   I/O Sync Max  Sync Avg                Async
 Volume Target     PSs     I/Os    %  I/O Wait  I/O Wait 0...20...40     I/Os
 BAB309 DB2H         1        9   2.0       35        19 *****              1
 BAB310 DB2H        16      141  31.0      325        24 ********         15
 BAB312 DB2H        21      144  31.6      175        24 ********          43
 BAB314 DB2H         5       25   5.5      667        41 **********+       12
 BAB316 DB2H         4       14   3.1       38        14 ****               0
 BAB318 DB2H         9       50  11.0       73        22 ******           21
 BAB319 DB2H         1        2   0.4       31        17 *****              0
 BAB320 DB2H         5       24   5.3       51        19 *****              6
 BAB321 DB2H         1        3   0.7       32        22 ******             0
 BAB325 DB2H        13       40   8.8       47        20 ******             7
 BAB330 DB2H         1        3   0.7       40        20 *****              1
```

Figure 28. Volume I/O Summary—Session (PSVOLSZ)

9. Type **`SORT D`** and tab to **Sync Avg I/O Wait** to sort the volumes with the highest average delays to the top.

10. These values are based on activity since DB2 startup.

    To see a 2-hour summary of activity for one volume broken down into 15-minute intervals, hyperlink on **Sync I/Os**.

    Press **PF3** to return.

11. Hyperlink on a **volume** to see a list of all page sets on that volume.

    You may want to scroll to the right to see the asynchronous I/Os made for prefetch, since these I/Os have different access characteristics and delay times than do synchronous I/Os.

12. Press **PF3** until you return to EZDB2 and hyperlink on the **Page Set Menu** option to go to EZDPS.

    Hyperlink on any of the **I/O by Page Set** options to look at I/O counts and wait times per page set.

    - Sort on the **Avg I/O Wait** column to identify the highest average delays that can point out DASD response time problems.
    - Sort on **Max I/O Wait** to help identify occasional contention problems that are masked in the averages.

    Note: However, be aware that the maximum is since DB2 startup, not per interval. This does reduce its usefulness.

13. Press **PF3** until you return to EZDPS and hyperlink on **Cache Statistics** to analyze page usage in the buffer pools and hiperpools by page set, as shown in Figure 29.

Cache Statistics

```
17SEP2003  16:18:48 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSCACHE==========DB2H=====*========17SEP2003==16:18:48====MVDB2========77
 ------Page Set------- Bfrpl     VP       VP        VP      VP     VPTot VPTot
 Database Object   Prt  ID     Current  Maximum  Changed Max Chng  % All   %BP
 DB2HWORK DSN4K01  001 BP00          0        2        0        2    0.0   0.0
 DSNDB01  DBD01    001 BP00          7       23        0        6    4.0   3.5
 DSNDB01  DSNLLX01 001 BP00          9       10        0        6    5.2   4.5
 DSNDB01  DSNLLX02 001 BP00          3        8        0        6    1.7   1.5
 DSNDB01  DSNLUX01 001 BP00          3        4        0        2    1.7   1.5
 DSNDB01  DSNLUX02 001 BP00          2        4        0        2    1.2   1.0
 DSNDB01  DSNSCT02 001 BP00          0        3        0        1    0.0   0.0
 DSNDB01  DSNSPT01 001 BP00          0        3        0        1    0.0   0.0
 DSNDB01  DSNSPT02 001 BP00          0        4        0        1    0.0   0.0
 DSNDB01  SCT02    001 BP00          1        5        0        3    0.6   0.5
 DSNDB01  SPT01    001 BP00          1        5        0        3    0.6   0.5
 DSNDB01  SYSLGRNX 001 BP00          8       13        0        7    4.6   4.0
 DSNDB01  SYSUTILX 001 BP00          3       12        0        5    1.7   1.5
 DSNDB06  DSNADH01 001 BP00          2        3        0        0    1.2   1.0
 DSNDB06  DSNAGH01 001 BP00          2        3        0        0    1.2   1.0
 DSNDB06  DSNAPH01 001 BP00          0        3        0        0    0.0   0.0
 DSNDB06  DSNATX01 001 BP00          2        3        0        2    1.2   1.0
 DSNDB06  DSNATX02 001 BP00          6        6        0        2    3.5   3.0
 DSNDB06  DSNATX03 001 BP00          3        4        0        2    1.7   1.5
 DSNDB06  DSNAUH01 001 BP00          2        3        0        0    1.2   1.0
 DSNDB06  DSNDCX01 001 BP00          7        7        0        4    4.0   3.5
 DSNDB06  DSNDDH01 001 BP00          2        3        0        0    1.2   1.0
 DSNDB06  DSNDDX02 001 BP00          0        3        0        0    0.0   0.0
 DSNDB06  DSNDKX01 001 BP00          2        3        0        1    1.2   1.0
 DSNDB06  DSNDLX01 001 BP00          2        3        0        1    1.2   1.0
 DSNDB06  DSNDPX01 001 BP00          2        3        0        1    1.2   1.0
```

Figure 29. Page Set Cache (PSCACHE)

You may want to sort on the **VP Current** column (descending) to sort those with the highest current storage usage to the top. The VP Changed and VP Max Chng columns identify those page sets with update activity.

14. Press **PF3** until you return to EZDPS and hyperlink on **Summary by Buffer Pool** for assistance in balancing table space allocations to the proper buffer pools, as shown in Figure 30.

Balance Table Space Allocations

```
17SEP2003  16:21:03 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSBPSZ============DB2H=====*========17SEP2003==16:21:01====MVDB2====D====1
 Bfrpl   DB2       Nr.    VP        VP       HP      Total    VP Max  VPMaxChg
  ID    Target     PSs  Current  Changed  Current     I/Os  (1 PSet)  (1 PSet)
 BP00   DB2H        77      173        0        0     1341        23        15
 BP02   DB2H        23       12        3        0      522        84         8
```

Figure 30. Buffer Pool Page Set Summary—Session (PSBPSZ)

The view PSBPSZ gives you a quick overview of how all the buffer pools are being used.

15. Hyperlink on Bfrpl ID to see a list of all page sets allocated to that pool (PSBPS). Sort on the VP Current column (descending) to sort those with the highest current storage usage to the top.

    The VP Changed and VP Max Chng columns identify those page sets with update activity.

16. Press **PF3** until you return to PSBPSZ. Hyperlink on **VP Current** for a 2-hour history.

17. Press **PF3** until you return to EZDB2.

Use Monitors to Isolate Problems

Monitors sample key measurements over time and save short-term history. When thresholds are specified, the measured values are compared and automatic warnings generated.

A default set of monitors defined in BBPARM member BLKDMRW is automatically started. This set can be tailored for each DB2 system with different monitors or different thresholds.

To view the active monitors:

1. From the Primary Option Menu, select the **MONITORS** option.

   ```
   OPTION ===> 3            (Active Timer Requests)
   ```

   All ***active*** monitors are listed here. The current measurement values are shown and plotted compared to the thresholds. The W in the middle marks the warning threshold values. All monitors with acceptable values remain on the left side of the W. Those in warning status extend to the right and are highlighted, as shown in Figure 31.

Warning Status

```
 BMC Software --------------- ACTIVE TIMER REQUESTS ----------  PERFORMANCE MGMT
 COMMAND ===>                                                  TGT ===> DB2G
                                      INPUT    INTVL ==> 3      TIME --  10:52:10
 COMMANDS: SM (START MONITORS), SORT, AREA, X ON|OFF, DM (DMON), DW (DWARN)
 LC CMDS: S (SELECT), W (SHOW),      M(MODIFY),
          P (PURGE),  R (REPLICATE), H (HELP), Z (STOP)                    >>>
LC   SERV  PARM     TITLE                   CURRENT  WVAL |-8-6-4-2-0+2+4+6+8+|
     CONUT TSO      CONNECTION % UTILIZATION     35    80 |<<<<<<<< W         |
     CONUT BATCH    CONNECTION % UTILIZATION      2    80 |**       W         |
     CONUT DBAT     CONNECTION % UTILIZATION     18    80 |>>>>     W         |
     THDUT          THREAD % UTILIZATION         50    85 |<<<<<<<  W         |
     THDQD CICS     QUEUED THREADS                0    NZ |          W         |
     THDWT          CREATE THREAD WAITED          0     5 |          W         |
     EDMPL          EDM POOL % UTILIZATION       89    85 |>>>>>>>>>W>>>      |
     BPUTL BP0      BFR POOL % UTILIZATION       76    85 |******** W         |
     BPUSE BP0      BFR POOL % IN USE            33    85 |***      W         |
     RIDUT          RID POOL % UTILIZATION       45    85 |<<<<<    W         |
     LOGUT          ACTIVE LOG % UTILIZATION     53    85 |>>>>>>   W         |
     CSAP           CSA % UTILIZATION            95    80 |>>>>>>>>>W>>>>>>   |
     ECSAP          ECSA % UTILIZATION           79    80 |******** W         |
     DSUTL          OPEN DB DATASET % UTIL       24    85 |**       W         |
     DSOPN          DB DATA SETS OPEN            38    60 |>>>>>    W         |
     DB2DP DBAS     DEMAND PAGING               600  1800 |<<<      W         |
     LTIME          LOCK TIMEOUT FAILURES         1     5 |**       W         |
     LDEAD          LOCK DEADLOCK FAILURES        0    NZ |          W         |
     EDMLD DBD      AVG EDM REQUESTS/LOAD         0   140 |          W         |
     RWP            READS WITH PAGING             0    NZ |          W         |
     WWP            WRITES WITH PAGING            0    NZ |          W         |
     GETPG BP0      GETPAGE REQUESTS           1144  1000 |*********W**       |
```

Figure 31. Active Timer Requests Application

2. Type **X ON** on the COMMAND line to view only those monitors in exception status.

   We'll investigate exceptions more thoroughly later.

3. To find out how to start a monitor (and generate an exception to view):

   ```
   COMMAND ===> SM          (Start Monitor)
   ```

   This application displays a list of all available monitor services. (SM is an ***application transfer*** command that saves your current position and transfers you to another application. You can type a transfer command in any COMMAND line or SERV field.)

Start a Monitor

Monitors look at either resources/system activity (resource monitors) or at workload activity (workload monitors). One workload monitor can be started multiple times to look at different workloads to help isolate specific workload-related problems. Some resource monitors also have parameters to support multiple requests—for example, buffer pool number.

There are many available monitors. You can scroll through the list with PF7/8, sort on any of the columns, or select only those monitors for the area in which you are interested.

To practice starting a monitor:

1. Type **AREA WKLD** on the COMMAND line.

   All workload monitor names start with **#** (for a count) or with an **@** (for an average).

2. Type **S** in the line command column next to #SQLM to select a workload monitor.

   By selecting #SQLM, you can view some immediate activity because this service measures the number of DML statements issued.

   This takes you to the data entry panel, as shown in Figure 32.

Using Defaults

```
BMC Software --------- START DB2 WORKLOAD MONITOR REQUEST ---  PERFORMANCE MGMT
COMMAND ===>                                                 TGT ===> DB2G

                      #SQLM - DATA MANIPULATIVE SQL

PARM     ==>                                (Workload Monitor Identifier)
INTERVAL ==> 00:01:00 START ==>             STOP ==>                 QIS ==> YES
WVAL     ==>          WMSG  ==>             WLIM ==> 10  WIF ==> 1   WIN ==> 1
TITLE    ==>                                (Title)
RST      ==> HOT                            (Restart Option: HOT,COLD,PUR,QIS)
PLOTMAX  ==>                                (Maximum PLOT X-Axis Value)
RANGES   ==>                                (1-4 Range Distr. Upper Limits)
LOG      ==>                                (NO,ATSTOP,ATPD,ATINTVL,ATWARN)
Specify Selection Criteria:
   ICHECK   ==> NO                          (Check elapsed versus Interval time)
   CONNTYPE ==>                             (TSO, IMS, CICS, BATCH, CAF or blank)
   DB2PLAN  ==>
   DB2AUTH  ==>
   DB2CONN  ==>
   DB2CORR  ==>
   DB2LOC   ==>
```

Figure 32. Start DB2 Workload Monitor Data Entry Panel

3. Define optional workload monitor data collection parameters on the data entry panel using mostly defaults.

   a. `PARM ==> **id**`

      You can specify any name as an ID if you want several requests for this monitor to look at different workloads.

   b. `INTERVAL ==>`

      Use the default (00:01:00) of one minute data collection intervals.

   c. `START ==>`

      Use the default to start at the next even minute, or type a future time in the format of hh:mm:ss.

      Note: The monitors are synchronized to the even minute to make it easier for you to compare the history values they collect.

   d. `STOP ==>`

      Use the default of no stop time, or type a time at which you want the monitor to stop in the format of hh:mm:ss, or the number of intervals (minutes).

   e. `WVAL ==> **warning threshold value**  Maximum (n) or Minimum (<n)`

      A warning message is issued automatically when a sampling exceeds the monitor threshold. Type a low value so you can see a warning. For example, if you expect 100 statements in a minute, type 50. It can be changed to a more appropriate value later.

   f. `WMSG ==>`

      If left blank, a warning message is sent to the Journal log when sampling exceeds the monitor threshold (also triggers AutoOPERATOR EXECs). Current warnings are shown on DB2EX. Specify **`WTO`** to also send a message to the MVS console, or a **`TSO id`** to send a message to that user.

   g. Optional fields: (For this exercise, accept the defaults)

WLIM	Limit number of warnings sent
WIF	Wait n intervals before issuing a warning
WIN	Wait n intervals before sending nth warning
RST	Monitor reaction if DB2 stops and is restarted
PLOTMAX	Specifies maximum value of X Axis on monitor plot display
RANGES	Limits for range distribution statistics on plot display
LOG	A hardcopy plot is recorded in the BBI-SS PAS Image log

4. Specify workload selection criteria.

   `DB2CONN ==> **name,name,name**`

   Optional. Type one or more names, where name can be TSO, BATCH, DB2CALL, an IMSID, or a CICS jobname. Leave blank for total workload.

5. Press **Enter** to start the monitor and return to the list of monitors.

6. Access the Active Timer Requests (AT) display to make more requests.

```
COMMAND===> AT     (transfer to Option 3 - MONITORS)
 or    ===> =3     (a quick jump without saving a return path)
```

7. Type **`R`** in the line command column next to an active workload monitor to replicate an active monitor request.

   This replicates the request parameters.

8. Make another request by typing a unique ID in the PARM field and specifying different selection criteria. Press **PF1** (HELP) for an explanation of the values that can be specified, as shown in Figure 33.

Getting Help

```
BMC Software --------- SET KEYWORDS - WORKLOAD SELECTION CRITERIA ---- TUTORIAL


The following keywords can be used to qualify data collection by a workload
monitor:

CONNTYPE   TSO|IMS|CICS|BATCH|CAF|blank
           IMSMPP|IMSBMP|IMSTBMP|IMSCTL|DLI|SYSSERV|APLSERV|UTIL (DMR 3.1 and
           above)
            These keywords allow workload selection by connection type.
            Blank is the default, which selects all the connection types.

ICHECK     YES|NO
            If YES is specified, the transaction is discarded if the elapsed
            time is greater than the requested interval time.  NO is the
            default.

            Data is only available at transaction termination time.  YES
            prevents long running transactions from skewing the interval
            statistics.

                                                        continued next page...
```

Figure 33. Sample Help Panel

9. Press **Enter** to start the monitor and return to Active Timer Requests.
10. Move the cursor to the COMMAND line and continue to press **Enter** until the new monitors show an ACTIVE status and current measurement values. (Remember, they were synchronized to start at an even minute.)
11. Check that at least one monitor is in warning status (line highlighted).
12. Use the Modify line command to view the monitor options in effect and to modify any that are preceded by an arrow.

    ```
    LC   (Line Command)
     M   (for Modify)
    ```

    Choose an active monitor and change its threshold value.

    ```
    WVAL ==> n     (Maximum)
    WVAL ==> <n    (Minimum)
    ```

    If you did not start this monitor, you need special authorization to modify or purge it.
13. Press **PF3** to return to the AT panel.

    Look at how the graph of the current value compared to the new threshold has changed.

    Note: To stop a monitor, use the **Z** line command.

You now know how to start and modify monitors. The next dialog shows you how to look at the data.

Review Critical Problems

To review critical problems, including those just identified by monitors, return to the **DB2EX** analyzer service.

- Type

```
 OPTION  ===> 2        (from the Primary Option Menu)
COMMAND  ===> AN       (transfer to ANALYZERS)
   or    ===> =2       (jump to Option 2)
```

  Then type **S** in the line command column next to the DB2EX service.

- An even quicker way, if you remember the name of the display you want, is

```
COMMAND ===> EXEC DB2EX
```

  Note: If you want a display with one or more parameters, type **EXEC serv parm1,parm2** on the COMMAND line. For example: **EXEC BFRPL BP0**.

- In a service display, just overtype SERV ===> **DB2EX** and clear any PARM values.

Note: To print any display while you are looking at it, use **PF4** for screen print. To print a series of displays while you are viewing them, specify **LOG=Y** in line 2.

Exceptions

To review the information on the exception panel:

1. Move the cursor to a message and press **Enter**.

   A detailed explanation of the message is shown by the MESSAGES general service.

2. Press **PF3** to return to the DB2EX display.

   The exception display lists the time the exception occurred and the severity (S for severe, W for warning, I for informational, M for monitor messages). You can enter the severity code in the PARM field to select the messages for display by severity level, as shown in Figure 34.

Severe Messages

```
BMC Software --------------      DB2 EXCEPTIONS      ----------PERFORMANCE MGMT
SERV ===> DB2EX            RUNNING 11:25:05 INTVL =>  3  LOG => N  TGT ==> DB2G
PARM ===> S                 EXCEPTIONS DISPLAYED   1 -  10 of  10 SCROLL=> CSR
EXPAND:  MON(DSYS), LINESEL(MSG)

TIME      LEV  MSGNO            EXCEPTION

11:24:00   S DZ1090S FINAL ACTIVE LOG DATASET 75% FULL
11:24:00   S DZ1110S BSDS REDUCED TO SINGLE MODE
11:23:00   S DZ1020S IMS TASK(S) QUEUED FOR THREAD(S)
11:20:00   S DZ1050S BP(0) DM CRITICAL THRESHOLD REACHED
```

Figure 34. DB2 Exceptions Panel

Note: You have already learned how to change monitor thresholds. The background exception messages (S, W, I) are user-modifiable for each DB2 system independently in BBPARM member DMRBEX00. This is also where you specify thresholds for runaway query exceptions per connection type (TSO, CICS, and so on). These exceptions can be triggered based on CPU percent, GETPAGEs, CPU total, elapsed time, or updates per commit.

Warning Overview

To return to the list of active monitors (Active Timer Requests - AT) for an overview of important system measurements:

1. Type

   ```
   SERV ==> =3          (transfer to Option 3 - MONITORS)
   ```

   Where warning thresholds are specified, the current value is plotted compared to the threshold (W marker). Arrow signs indicate an increasing (>) or decreasing (<) trend. (Yellow if increasing.)

   If the threshold is exceeded, that monitor line is highlighted (red) and a corresponding warning message is shown in the Exceptions display (DB2EX).

Usually, a standard set of monitors is started automatically to collect data whenever the target DB2 is up. Look at all monitors already in warning status or approaching it. For example, if both LOCK TIMEOUT FAILURES and THREAD PERCENT UTILIZATION are high, as shown in Figure 35, the lock contentions are probably caused by a high level of user activity. If only the timeouts are in warning status, a single batch job may be holding too many locks (analyzer LOCKU shows details).

Lock Contention ==>

==>

```
 BMC Software --------------- ACTIVE TIMER REQUESTS ----------  PERFORMANCE MGMT
 COMMAND ===>                                                  TGT ===> DB2G
                                    INPUT    INTVL ==> 3      TIME --  10:52:10
 COMMANDS: SM (START MONITORS), SORT, AREA, X ON|OFF, DM (DMON), DW (DWARN)
 LC CMDS: S (SELECT), W (SHOW),      M(MODIFY),
          P (PURGE),  R (REPLICATE), H (HELP), Z (STOP)                    >>>
LC   SERV  PARM     TITLE                   CURRENT  WVAL |-8-6-4-2-0+2+4+6+8+|
     CONUT TSO      CONNECTION % UTILIZATION     35    80 |<<<<<<<< W         |
     CONUT BATCH    CONNECTION % UTILIZATION      2    80 |**       W         |
     CONUT DBAT     CONNECTION % UTILIZATION     18    80 |>>>>     W         |
     THDUT          THREAD % UTILIZATION         89    85 |>>>>>>>>>>W>>>     |
     THDQD CICS     QUEUED THREADS                0    NZ |          W         |
     THDWT          CREATE THREAD WAITED          0     5 |          W         |
     EDMPL          EDM POOL % UTILIZATION       50    85 |<<<<<<<  W         |
     BPUTL BP0      BFR POOL % UTILIZATION       76    85 |******** W         |
     BPUSE BP0      BFR POOL % IN USE            33    85 |***      W         |
     RIDUT          RID POOL % UTILIZATION       45    85 |<<<<<    W         |
     LOGUT          ACTIVE LOG % UTILIZATION     53    85 |>>>>>>   W         |
     CSAP           CSA % UTILIZATION            72    80 |>>>>>>>> W         |
     ECSAP          ECSA % UTILIZATION           80    80 |*********W         |
     DSUTL          OPEN DB DATASET % UTIL       24    85 |**       W         |
     DSOPN          DB DATA SETS OPEN            38    60 |>>>>>    W         |
     DB2DP DBAS     DEMAND PAGING               600  1800 |<<<      W         |
     LTIME          LOCK TIMEOUT FAILURES         8    NZ |*********W******** |
     LDEAD          LOCK DEADLOCK FAILURES        0    NZ |          W         |
     EDMLD DBD      AVG EDM REQUESTS/LOAD         0   140 |          W         |
     RWP            READS WITH PAGING             0    NZ |          W         |
     WWP            WRITES WITH PAGING            0    NZ |          W         |
```

Figure 35. Active Timer Requests Application

More Detailed Information

To view more detailed information:

1. If you are interested in one specific area, such as buffer pools, you can narrow down the display to show only the related monitors.

   ```
   COMMAND ===> AREA BUFR      (enter AREA alone to see them all again)
   ```

   This makes it easier to concentrate on just the buffer information; for example, to compare the GETPAGE REQUESTS to READ I/O and PREFETCH READ I/O.

2. If you don't see the data you want, you can use the same technique to review the other available monitors for buffer pool information.

   ```
   COMMAND ===> SM          (Option 2 - START MONITORS, with stacking)

   COMMAND =>   AREA BUFR
   ```

   You could start additional buffer pool monitors now, just the way you did for #SQLM.

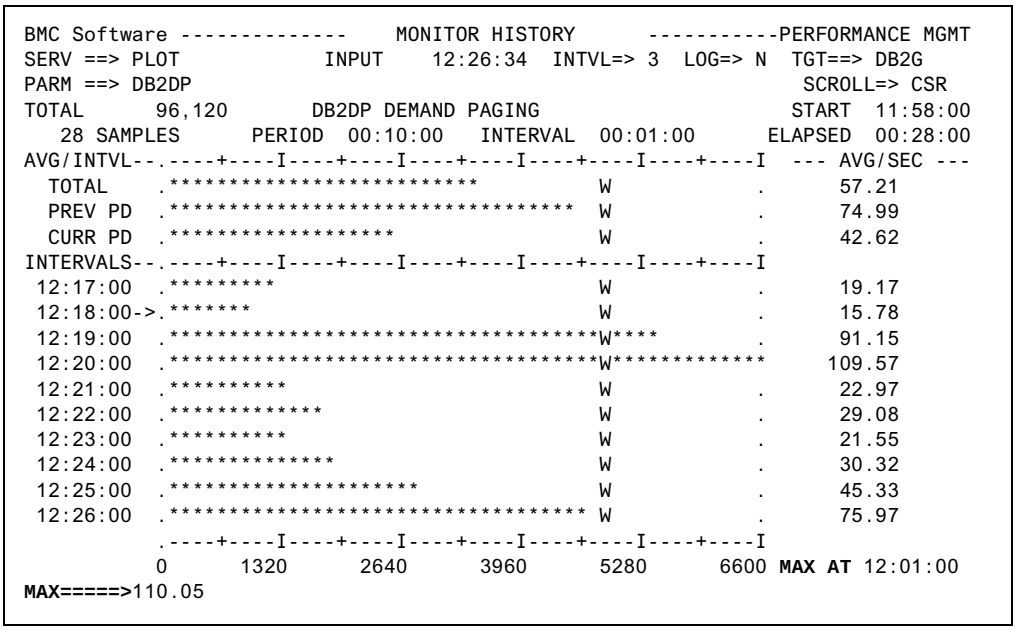
3. Press **PF3** to return to the list of active monitors.

4. Use the Select line command to view the history collected by a monitor.

   ```
   LC   (Line Command)
    S   (for Select)
   ```

   Choose an active monitor that is showing non-zero for the current value. If the DB2 you are monitoring is very active, there should be several, including the #SQLM monitor you just started. If not, choose one of the MVS-related monitors such as CSAP, CSA Percent Utilization.

   This standard **PLOT** display, shown in Figure 36, is used to show the latest 10 values measured by any monitor. For further trending information, the averages for the total monitoring period and the last 2 periods (10 samples each) are also shown. The threshold value is indicated with a W in the graph. Note the **MAXimum** value ever measured and the time it occurred (MAX AT). Rate per second calculations (in this example, paging rates) are shown at the right.



Rates/Second

Maximum Value

Figure 36. Sample PLOT Display

5. Press **PF3** to return to the list of active monitors.
6. Restrict the display to monitor exceptions only.

   COMMAND ===> **X ON**

7. Press **PF6** to start automatic refresh mode, or type

   COMMAND ===> **GO**

   Check to see that the word **INPUT** on line 3 has been replaced by **RUNNING**.

   You can start automatic refresh whenever you want to watch for problems or events without continually pressing **Enter**.

8. Press **ATTN** to stop refresh and enable command entry.
9. Return to the full display.

   COMMAND ===> **X OFF**

10. Change to some other installed MAINVIEW product.

    COMMAND ===> **product name**

    IMS, CICS, DB2, AO, CAO, IAO, and MAO are valid names.

    This saves your current place and presents the Primary Option Menu of that product. You can even stack copies of MAINVIEW for DB2 by typing **DB2.** This can be useful when you must look at another system or product (for example, to answer a user question about production), but you don't want to lose your place.

11. Return to your original place (Active Timer Requests).

    COMMAND ===> **=X**

    You can also press **PF3** in the stacked environment until you exit from its Primary Option Menu.

Windows-Mode Monitor Views

All of the monitor data you have just seen in full-screen displays is also available in windows mode. Both the EZDB2 and EZDSSI Easy Menus have several hyperlinks to monitor views, as shown in Figure 37.

Monitor Views ==>

```
17SEP2003  16:32:36 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                  SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =EZDSSI===========(ALL======*=======)17SEP2003==16:37:22====MVDB2====D====1
                              DB2 SSI Easy Menu
    Status                                                Threads
  . Overview                +----------------------+  . Current Threads
  . Exceptions              |   Place cursor on    |  . DB2 Summary
  > Buffer Pools            |    menu item and     |  . Attach Summary
  > Status Menu             |     press ENTER      |  . Connect Summary
                            +----------------------+  . Plan Summary

    Data Sharing              Monitors
  . GBP Group Status        . In Warning                Tools And Menus
  . GBP Group Activity      . Summary By Area         . Set SSI Context
  . Global Lock Stats       . Active                  > Easy Menu
  . Global Lockouts         . Workload Objectives     > MAIN Menu
  . Volume I/Os (SSI)                                 > Tuning Wizards
  > Page Set Menu                                     . Return...
```

Figure 37. DB2 SSI Easy Menu (EZDSSI)

The monitor views are able to provide an SSI perspective on monitor status, as well as the details for one DB2. To see these views:

1. Check to be sure that you have an SSI context in effect. If not, type

   CON ALL

2. Hyperlink on **Monitors—In Warning** to see a view of all monitors in warning status in that SSI context, as shown in Figure 38.

See All Warnings

```
17SEP2003  11:59:40 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                  SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =DMWARN============DB2HC====*========17SEP2003==11:59:39====MVDB2====D====1
CMD Serv  Parm             % Warning    Curr     Warn     Area Target
--- ----- --------       0.....50...100 Value--- Value--- ---- --------
    @ELTM ALLWORK  319.3 *************+     3.19     1.00 WKLD DB2HC
    CSAP           136.0 *************+    68.00    50.00 DMVS DB2HC
```

Figure 38. Monitors in Warning (DMWARN)

3. Hyperlink on the **Serv** column to see the equivalent of the full-screen PLOT display, as shown in Figure 39.

   Notice that the time intervals here have the most recent times at the top. Each plot view has a hyperlink to a related full-screen display.

Monitor Plot in Windows Mode

```
17SEP2003  12:01:55 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                        1                          SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =DMWARN===D@ELTM===DB2HC====*========17SEP2003==12:00:58====MVDB2====D====1
   >>USERS   |.....|......|  Elapsed   Events Parm..... ALLWORK
   12:00:30                   66.108      3  Appl..... SAMPLE
   11:59:00                    0.331      6  Warning..     1.00
   11:57:30                    0.000      0  Max/Min..  Maximum
   11:56:00                    0.000      0   Value...  2304.72
   11:54:30                    0.000      0   Time.... 11:48:30
   11:53:00                    0.000      0  Graph Max  2304.72
   11:51:30                   16.022      1  Target... DB2HC
   11:50:00                    0.000      0  Descript. Sample DB2 Workload
   11:48:30  **************  2304.721      2
   11:47:00                    2.330      1  Samples..       69
             |.....|......|  Elapsed   Events Period... 00:15:00
   Total     *                86.226     69  Samp Int. 00:01:30
   Prev Pd                     0.000      0  Start.... 10:17:00
   Curr Pd                     3.361     28  Elapsed.. 01:43:30
```

Figure 39. Sample Plot View

4. Press **PF3** twice to return to EZDSSI.

5. Hyperlink on **Monitors—Summary by Area** to see a summary of active monitors and their warning status by target and area, as shown in Figure 40.

See Monitors by Target and Area

```
17SEP2003  18:05:18 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =DMAREAZ==========(ALL======*=======)17SEP2003==18:05:16====MVDB2========10
CMD                     Number  Number            Average Maximum Number
--- Target   Area     Monitors in Warn 0.......10 Warning Warning Active
    DB2GC    DMVS            2       0              74.1    95.2      2
    DB2HC    EDM             2       0              40.0    40.0      2
    DB2HC    DMVS            5       1 *            38.4   136.0      5
    DB2HC    LOG             8       0              11.8    23.5      8
    DB2HC    LOCK            8       0               1.6     8.0      8
    DB2HC    DSYS            4       0               1.5     2.4      4
    DB2HC    USER           22       0               0.8     3.7     22
    DB2HC    DDF             3       0                               3
    DB2HC    WKLD            6       1 *           319.3   319.3      6
    DB2HC    BUFR           24       0                              24
```

Figure 40. Monitor Summary by Area (DMAREAZ)

   The hyperlinks provide a list of the monitors.

6. Press **PF3** to return to EZDSSI.

7. Hyperlink on **Monitors—Active** to see a summary of active monitors per target DB2.

   Additional views are available to show the monitor data from a realtime (DMONR) or session (DMONS) perspective, while DMONC shows all time perspectives in one view.

8. Press **PF3** to return to EZDSSI.

Workload Objective Views

Special workload monitors are started automatically for you to provide service-level monitoring of response time per workload.

Several default workloads have been predefined for transaction and query connections to DB2, based on connection type. Please refer to Volume 1 of the *MAINVIEW for DB2 User Guide* if you want to add workloads or modify the response time objectives of the existing workloads.

To see if you are meeting your response time goals for the defined workloads:

1. From EZDSSI, hyperlink on **Monitors—Workload Objectives** to review workload objectives, as shown in Figure 41.

Are You Meeting Your Goals?

```
17SEP2003  11:59:40 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =DOBJ==============(ALL=====*=======)17SEP2003==14:49:33====MVDB2====D====1
CMD Workload       % <= Resp Goal Resp  Goal Avg     Tran  Composite Target
--- Name----       0.....50...100 Goal-    % Resp--- Count Workload- --------
    ALLWORK   95.6 *************   1.00   95   0.843   125 SAMPLE    DB2H
    ALLWORK   66.7 *********       1.00   95   1.428   167 SAMPLE    DB1H
    CAF      100.0 **************  5.00   90   3.221     2 DB2SAMP   DB1H
    CICS     100.0 **************  1.00   95   0.543   160 DB2SAMP   DB1H
    DBATDB2   00.0                 5.00   90   0.000     0 DB2SAMP   DB1H
    DBATDRDA  00.0                 5.00   90   0.000     0 DB2SAMP   DB1H
    IMSMPP    00.0                 1.00   95   0.000     0 DB2SAMP   DB1H
    TSO       52.1 *******         5.00   90   7.331     5 DB2SAMP   DB1H
```

Figure 41. Objectives Review (DOBJ)

The graph shows what percentage of all threads in that workload have met the response time goal.

Audit Trail

To view an audit trail of problems throughout the day:

1. When in fullscreen mode, transfer to the Log Display general service (Option L).

   ```
   COMMAND ==> LOG
   ```

   Or press **PF5**.

   When in windows mode, enter

   ```
   COMMAND ==> TRAN db2target DB2;LOG
   ```

   All ***MAINVIEW for DB2 messages*** are shown chronologically, as shown in Figure 42.

Look for Problems

```
BMC Software -------------------- Log Display -------------- General services
COMMAND ===>                                                 TGT ===> DB2G
LINE=      12,340  LOG= #1   STATUS= INPUT    TIME= 17:51:38 INTV===> 3
12:11:00  DS0560W  (04) 12:11:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:12:00  DS0560W  (05) 12:12:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:12:55  XS6311I  BBI/SESSION FOR -CPS17   - TERMINATED
12:13:00  DS0560W  (06) 12:13:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:14:00  DS0560W  (07) 12:14:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:15:00  DS0560W  (08) 12:15:00 ECSA % UTILIZATION(TOTAL) = 72  (>70) ********
12:16:00  DS0560W  (09) 12:16:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:17:00  DS0560W  (10) 12:17:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:22:11  XS6304I  BBI/SESSION FOR -LAA1    - TO -D31X- INITIATED
13:12:00  DS0561I   13:12:00 ECSA % UTILIZATION(TOTAL) NO LONGER > 70
13:28:48  DSNW131I - STOP TRACE SUCCESSFUL FOR TRACE NUMBER(S) 05
13:28:49  DSN9022I - DSNWVCM1 '-STOP TRACE' NORMAL COMPLETION
13:53:02  DS0560W  (01) 13:53:00 ECSA % UTILIZATION(TOTAL) = 72  (>70) ********
13:54:00  DS0560W  (02) 13:54:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:55:01  DS0560W  (03) 13:55:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:56:00  DS0560W  (04) 13:56:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:57:01  DS0560W  (05) 13:57:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:58:00  DS0560W  (06) 13:58:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:58:12  DSN3201I + ABNORMAL EOT IN PROGRESS FOR USER=LGS11
13:58:12  CONNECTION-ID=DB2CALL CORRELATION-ID=LGS11
```

Figure 42. Sample Log Display

You also can request an online audit trail of all ***DB2 system messages*** by specifying LOG=YES per target DB2 in the DMRBEX00 member of the BBPARM data set.

2. Check for exceptions that occurred in a specific period (Locate Time).

   ```
   COMMAND ==> T 1130
   ```

3. FIND a specific problem (and press **PF5** for RFIND). For example:

   ```
   COMMAND ==>  FIND DW0200W (#SQLM monitor warning)
   COMMAND ==>  FIND DSNT375 (DB2 deadlock messages)
   COMMAND ==>  FIND DZ0630W (Runaway TSO query)
   COMMAND ==>  FIND RUNAWAY (Runaway thread from any connection)
   COMMAND ==>  FIND DW0     (All workload monitor warnings)
   ```

4. Scroll to the left with **PF10** to see the origin of the messages.

   This value can be used to select a subset of the messages in the Journal log.

5. Type **PROFILE** on the COMMAND line to access the Enhanced Journal Facility, as shown in Figure 43.

Select Messages from One Target

```
BMC Software -------------------- Log Display -------------- General services
COMMAND ===>
                                                            Date --- 02/09/16
 Included Origins           Excluded Origins                Time --- 12:41:32

 DB2G____                     ________
 ________                     ________
 ________                     ________
 ________                     ________
 ________                     ________
 ________                     ________




    Press END to SAVE Profile and return to application
          CANCEL to discard changes
```

Figure 43. Enhanced Journal Facility

6. Type your **DB2 target name** (see the TGT field) in the Included Origins column. Return to the Log Display to view the messages only from that DB2.

   To also include DB2 messages, specify the target name followed by a plus sign (+), such as **DB2G+**. This specification selects messages from the DB2 address spaces, such as DB2GMSTR.

7. Issue the **PROFILE** command again and specify **&TARGET** in the Included Origins column to automatically select the messages from the current target DB2 subsystem. Also specify the **BBI-SS PAS id** to include MAINVIEW for DB2 messages.

Issue DB2 Commands

If you have the proper authorization in MAINVIEW for DB2 (this is not DB2 authorization), you also can issue DB2 commands from the fullscreen COMMAND line (usually from the Log Display so you can see the response):

1. Submit a DISPLAY THREAD command.

   ```
   COMMAND ==> -DIS THD(*)
   ```

   The command is automatically routed to the DB2 system shown in the target field. You do not need to know the subsystem recognition character (SSRC) for each DB2.

   The command response is shown in Figure 44.

DISPLAY THREAD Command Response

```
BMC Software -------------------- Log Display -------------- General services
COMMAND ===>                                                TGT ===> DB2G
LINE=      30,270  LOG= #1   STATUS= INPUT    TIME= 16:01:28 INTV===> 3
16:00:20  -DIS THD(*)
16:00:20  DSNV401I - DISPLAY THREAD REPORT FOLLOWS -
16:00:20  DSNV402I - ACTIVE THREADS -
16:00:20  NAME     ST A   REQ ID           AUTHID   PLAN     ASID
16:00:20  DB2CALL  T  *   143 DB231        D31X              0068
16:00:20  DB2CALL  T       30 OLTF         OLTF              00CF
16:00:20  X18H     N      300 0001DSN8IC0  PDRIVER           010D
16:00:20  X18H     N        2              BABUSER           00FC
16:00:20  CICSCN3  N        3              BABUSER           0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  DISPLAY ACTIVE REPORT COMPLETE
16:00:20  DSN9022I - DSNVDT '-DIS THD' NORMAL COMPLETION
```

Figure 44. Log Display

View All DB2 Commands

The MAINVIEW for DB2 – Data Collector provides a chronological log of DB2 commands. To view all the DB2 commands that have been issued since DB2 started:

1. From the EZDB2 Easy Menu, select the **DB2 Event Traces** option to access the System Event Traces Easy Menu (EZDEVENT), as shown in Figure 45.

```
W1 =EZDEVENT=========(DB2K=====*=======)17SEP2003==17:36:11====MVDB2====D====1
                        System Event Traces Menu
         DB2 Target ---> DB2K
                        +----------------------+
  Authorization Failures |   Place cursor on    |   DB2 Commands
. Failures by Time       |    menu item and     | . Commands Executed
                         |     press ENTER      |
  RID List Processing    +----------------------+   Data Set Open/Close
. RID Activity by Time                            . Open/Close by Time
. RID Proc. Summary                               . Summary by Database
. RID Failures-Storage
. RID Failures-Limit                              . Return...
```

Figure 45. EZDEVENT Easy Menu—DB2 System Event Traces

2. From the EZDEVENT Easy Menu, hyperlink on **Commands Executed** to access the DB2 Command History view, CMDLIST.

   From the CMDLIST view, you can identify who has issued commands and hyperlink to the CMDTEXT view to see the complete text.

Chapter 3. Monitoring a DB2 Data Sharing Group

Monitoring DB2 data sharing increases the complexity of both the environment and the number of tuning *knobs* that needs to be analyzed and optimized.

The first key requirement is to be able to focus on the level of data that is required to understand how the data sharing group is performing, or to solve a particular problem. Since a data sharing group consists of multiple DB2 members, and these members work together and share resources, viewing each DB2 individually is no longer adequate.

These scenarios show you how to look at all the members concurrently so you can easily compare activity and resource usage across the group, as well as access summarized data for the whole group, such as group buffer pool activity, total database I/O to the shared tables, or global lock contention. Of course, you will still drill down to an individual DB2 member for details as needed.

In this practice session, you

1. Define a Single System Image (SSI) context for the data sharing group(s).
2. Check on current group activity.
3. Look at page set considerations.
4. Analyze global lock contention.
5. Tune group buffer pools.

Note: This practice session takes approximately one hour to complete.

Define the Group Context

Start this scenario at the EZDSSI menu, described on page 9.

The first thing you need to do is make sure that you have a Single System Image (SSI) context defined for the data sharing group(s) you want to look at:

1. Select the **Set SSI Context** hyperlink (first option under Tools And Menus).

   This presents a view of all the defined SSI contexts for MVDB2, as shown in Figure 46.

All Defined MVDB2 SSI Contexts

```
17SEP2003 16:17:22 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =CONASEL==========SYSD=====*========17SEP2003==16:17:21====PLEXMGR==D====4
CMD SSI      Product  Description                              Num  Num
--- Context- -------- ------------                             Targ Act
    ALL      MVDB2    DB2 SSI context                             3    3
    ALLDB2   MVDB2    All DB2 Systems                             9    9
    DBGHC    MVDB2    DB2 5.1 Data Sharing Group                  2    2
```

Figure 46. SSI Context Selection List (CONASEL)

2. If you do have a context defined for the data sharing group you want to monitor, all you need to do is hyperlink on the context name. This returns you to EZDSSI with the new context in effect.

   If you don't have a context defined, you should define one now. (Even if you have a context defined, you may want to browse a little.) On the COMMAND line, type

   CONACTZ

   This view lists all SSI contexts (as known by your CAS and any connected CASs). Your CASID is shown on the window information line.

   If you have multiple MAINVIEW products installed, here you see one of the most powerful features of SSI—that the same context can be defined for several different MAINVIEW products. Obviously, since each product may look at different target types, the selection criteria can vary.

3. Select the default context of **ALL** for **MVDB2** to hyperlink to the CONACT view.

   Now you see each of the defined DB2 target subsystems, as shown in Figure 47.

All Defined DB2 Subsystems

```
17SEP2003 11:05:15 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =CONACTZ==CONACT===SYSD=====*========17SEP2003==11:02:43====PLEXMGR==D====3
CMD SSI      Product  Target   Status           Description
--- Context- -------- Context- of_Target---     ------------
    ALL      MVDB2    DB0HC    ACTIVE           MAINVIEW for DB2
    ALL      MVDB2    DB1HC    ACTIVE           MAINVIEW for DB2
    ALL      MVDB2    DB2HC    ACTIVE           MAINVIEW for DB2
```

Figure 47. SSI Context Activity Manager (CONACT)

4. Type **CONDEF** on the COMMAND line to access the context definition dialog.
5. Browse an example of a context definition.

   If a data sharing group context already exists, hyperlink on the SSI context name to see how the target filters were defined. If you don't see the group, select any other context. (You will at least see the default context of ALL.)
6. Press **PF3** to return to CONDEF.
7. Type **EDIT** on the COMMAND line to obtain an edit lock.
8. Type **ADD** on the COMMAND line to display the Add SSI Context Definition panel, as shown in Figure 48.

Add a New Context

```
17SEP2003 11:10:14 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =CONDEF============SYSD=====*========(00 EDIT          )====PLEXMGR==D===10

  ------------------------- ADD SSI CONTEXT DEFINITION --------------------
  COMMAND ===>

  SSI Context ===>
  Description ===>

  Inclusion Filters: (Target is included if any are true)
    1TGTNAME IN (DB1P,DB2P)
    2
    3
    4
    5
    6
    7
    8

  Equivalent SUBSTITUTION parameters to be used in filter expression:
   %1=TGTNAME     %2=TGTSYSTEM   %3=TGTPRODUCT  %4=TGTSERVER
   %5=TGTDESC

  Type  END to add the SSI context definition
        CANcel to leave without adding
```

Figure 48. Add SSI Context Definition Panel

In this panel, you define the context name and description and the selection filters for the targets that will be part of this context. Help is available on each of the fields.

You can define several filter conditions, but, in this case, all you will need is to filter by **TGTNAME** (the shorthand for this is **%1**). Since most sites use some kind of naming convention for the members, you probably only need one filter condition; for example:

```
%1 = DB?P
```

would include DB2s named DB1P, DB2P, and so forth.

If you prefer, you can define an IN list; for example:

```
TGTNAME IN (DB1P,DB2P)
```

would include only the DB2s named DB1P and DB2P.

9. Type the following commands to activate this definition:

   ```
   END       (to return to the CONDEF view and complete the ADD)
   SAVE      (to save the information)
   INSTALL   (to dynamically activate this SSI context in this CAS)
   ```

10. If there are multiple CASs involved, you need to complete this definition in each CAS. (CASACT will show you a list of CASs and you can type **CON casid** to switch to another CAS.)

11. If they all share the same BBPARM (you still see the new definition after you switch to another CAS), you only need to type

    ```
    CONDEF
    EDIT
    INSTALL
    ```

    Otherwise, you must repeat the whole set of steps.

Check Current Group Activity

Often you just want to check the health of each member of your data sharing group, and check on the activity levels. The previous dialogs covered how to check on multiple DB2s subsystems and their active threads. For data sharing, all you need to do is focus on just a data sharing group, instead of the default SSI context of ALL used earlier.

To view activity for a data sharing group:

1. You should have already set the context in the previous step. As a shortcut in the future, you can also simply type

   `CON context` `(example: CON DBGHC)`

2. Now you can select options from the EZDSSI menu to look at just this group.

   Try the **SSI Status - List DB2s** option again for a list of the DB2s in the data sharing group. This version of the STDB2 view is a good place to see how each DB2 member is performing. You can also drill down into details about a member.

   Another useful option is **Current Threads (Elap)**, which will now show all threads in the data sharing group, sorted by elapsed time.

3. Return to EZDSSI. You now have the choice of a Data Sharing Menu or the Data Sharing Wizard. First take a quick look at the menu, just so you know what is available. Now choose the **Data Sharing Wizard** option to access the Data Sharing Wizard (WZDSHAR) menu, as shown in Figure 49.

Access Data Sharing Options

```
05JUN2003  15:52:00 ------ MAINVIEW WINDOW INTERFACE(V4.1.07)MVDB2-------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSHAR==========(ALL======DB2K====)05JUN2003==15:52:00====MVDB2====D====1
** DATA SHARING WIZARD **         (Tgt) Target Values DB2K

. >> Set Context to Group
                                                      Interval  Session
Look at all Members?              Changed Page Writes        0        0
. Review Group (Session)          Read Hits..........        0        0

Narrow Focus from Session/Now?
. Review History and Set TIME

Global Locking                    (Tgt) Lockouts.....        0        3
. Lock Contention Wizard          (Tgt) % Global Cont      0.0      0.0
. CF Structures (MVMVS)

GBPs Right Size/Ratio?            Read Hit Ratio.....      0.0      0.0
. Check GBPs                      XIs-Dir. Reclaims..        0        0
                                  Write Failures.....        0        0
Page Set Considerations?
. Check GBP-DEP by GBP/PS         (Tgt) GBP-Dep......                 0
. Check GBP-DEP by Member
. Check I/O per Volume (SSI)

Castout/Checkpoints Effective?    Pages Castout......        0        0
. Check Thresholds & Activity

All OK?  Congratulations!
  (PF3 to Exit Wizard)
```

Figure 49. Data Sharing Wizard (WZDSHAR)

This wizard collects the most used options for data sharing in one place, including access to group buffer pool activity and status, global lock contention, and page set analysis that summarizes activity from all members. We will return here later.

The rest of this exercise will cover use of the wizards, but you also have direct access to some detailed data views here.

4. Another tip to find information quickly on specific data sharing topics is to use the Topic Index to look up the DB2 term that you are interested in, such as “Group Buffer Pools” and “GBP-Dependent” in the **TOPICG** view or “Locks–Global” in the **TOPICL** view, as shown in Figure 50.

   At any point when looking at another view, you can enter a view name **TOPIC*x*** to directly access topics starting with that letter; for example, type **TOPICL** for lock information.

Look Up the DB2 Topics You Want to See

```
05JUN2003  16:19:45 ------ MAINVIEW WINDOW INTERFACE(V4.1.07)MVDB2-----------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =TOPICL==========(ALL======*=======)05JUN2003==16:19:45====MVDB2====D===

DB2 Topic Index - L         View     SSI Monitor ZPARM    Acctg  Trac
Latch Waits                  -        -   -       -        -     DTL
List Prefetch               BFRPL     Y  PFL*     -       TSTAT   -
LOBs
 Access                      -        -   -       -       HT     SUM
 Storage                    STDBSYSD  Y  LOBMX   ZPSTGD   -      -
Local SQL Cache             STCACHED  Y   -      ZPTHDD   -      -
Locks
 Activity                   STLOCKD   Y   -      ZPIRLMLD HT      -
 Avoidance(Commit LSN)       -        -   -       -        -     DTL
 Contention                 WZLOCK    Y   -      ZPIRLMLD  -      -
 Current Held               LOCKU     -   -       -        -      -
 Current Object             LOCKD     -   -       -        -      -
 Current Susp. Threads      THDACTV   Y   -       -        -      -
 Escalations                STLOCKD   Y  LESCL    -       HT(X)  DTL
 Global Suspends            STGBLLKD  Y  GSUSP    -       TSTAT   -
 Maximums-NUMLKUS/TS         -        -   -      ZPIRLMLD  -      -
 Physical                   STGBLLKD  Y   -       -        -     LOCK
 Suspends                   STLOCKD   Y  IN(*)   ZPIRLMLD HT     DTL
 Timeout Factors             -        -   -      ZPIRLMLD  -      -
 Waits                       -        -   -       -       TSTAT  SUM
 Global                     STGBLLKD  Y   -       -       TSTAT   -
 IRLM Definitions            -        -   -      ZPIRLMDD  -      -
Lockouts                    STLOCKD   Y  IN(*)   ZPIRLMLD HT(X)  EV/D
LOCK TABLE Statements       STSQLD    Y   -       -       TSTAT  SUM
Logging
 Buffers                    STLOGD    Y   -      ZPLOGD    -      -
 Buffer Waits               STLOGD    Y  LOGWT    -        -      -
 Reads                      STLOGD    Y  LOGRD    -        -      -
 Writes                     STLOGD    Y  LOGWR    -        -      -
 Write Waits                 -        -   -       -       TSTAT  SUM
Logical Locks               STLOCKD   Y   -       -       HT      -

. Link to next page
```

Figure 50. Topic Index View (TOPICL) for Topics Beginning with the Letter L

5. Press **PF3** to return to EZDSHAR.

Look at Page Set Considerations (I/O / GBP-DEP)

Data sharing means that some or all of the DB2 tables can be accessed concurrently from all members of the group. But the tools provided by DB2 to understand the impact of this are limited. This section shows the power of what SSI can do to make this easier.

To look at page set considerations:

1. One of the key tuning areas in DB2 is I/O analysis. But looking at I/O for shared page sets or volumes from one DB2 member at a time does not give a complete picture.

   Select **Volume I/Os (SSI)** from the data sharing menu, EZDSHAR, to see a view of total I/O per volume from all members (PSVOLSSI), as shown in Figure 51.

Volume I/O for the Group

```
17SEP2003 15:46:52 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSVOLSSI=========(DBGHC====*=======)17SEP2003==15:46:37====MVDB2===D====13
            Sync    I/O Sync Max  Sync Avg                  Async    I/O     Async
 Volume     I/Os     %  I/O Wait  I/O Wait 0....20...40     I/Os    %      Pages
 BAB309        6   0.4        31        17 *****              2   0.0          2
 BAB310      309  19.9       354        23 *******           31   0.5        104
 BAB311        3   0.2        38        20 ******             0   0.0          0
 BAB312     1120  72.3     10322        32 **********      5732  91.8      44287
 BAB314        8   0.5        98        29 *********          0   0.0          0
 BAB317       36   2.3       176        27 ********           0   0.0          0
 BAB318        5   0.3        27        16 *****            0   0.0          0
 BAB322       12   0.8        38        14 ****             449   7.2       3535
 BAB325        9   0.6        52        16 *****              0   0.0          0
 BAB330        8   0.5       104        25 ********           0   0.0          0
 BAB331        8   0.5        30        15 ****              19   0.3        143
 BAB332       15   1.0        30        10 ***                8   0.1         61
 TSG314       11   0.7        31        16 *****              3   0.0         14
```

Figure 51. Volume I/O SSI Summary—Session (PSVOLSSI)

2. Select **one of the volumes** to see how many page sets are being accessed on that volume from each DB2 (PSVOLSZ), as shown in Figure 52.

Volume I/O per Member

```
17SEP2003 15:50:40 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSVOLSZ==========(DBGHC====*=======)17SEP2003==15:50:39====MVDB2====D====2
         DB2       Nr.     Sync   I/O Sync Max  Sync Avg                Async
 Volume Target     PSs     I/Os    %  I/O Wait  I/O Wait 0...20...40     I/Os
 BAB312 DB1HC       13       69   4.1    10322       188 **********+        0
 BAB312 DB2HC       17     1102  66.1     1796        22 ******          5732
```

Figure 52. Volume I/O Summary—Session (PSVOLSZ)

3. Select **Nr. PSs** for one of the members to see a list of each page set (PSVOLPS) with I/O data for just that member.

4. Press **PF3** to return to PSVOLSZ and select **the volume** instead.

   Now you see a list of all page sets on that volume (PSVOLPSZ) and can see how many members access each. The I/O data here shows totals for the group.

5. Select **the volume** once again.

   Now the list shows each page set with the I/O data broken down per member (PSVOLPS), as shown in Figure 53.

I/O per Page Set and Member

```
17SEP2003 15:53:44 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSVOLPS==========(DBGHC====*=======)17SEP2003==15:53:33====MVDB2===D====30
        ------Page Set-------  DB2         Sync  Sync Max  Sync Avg
 Volume Database Object   Prt Target       I/Os  I/O Wait  I/O Wait 0...20..40
 BAB312 DSNDB01  DSNLLX02 001 DB1HC           4        29        12 *
 BAB312 DSNDB01  DSNLLX02 001 DB2HC          11        28        24 **
 BAB312 DSNDB01  DSNSPT01 001 DB1HC           5        28        17 **
 BAB312 DSNDB01  DSNSPT01 001 DB2HC           8        29        15 **
 BAB312 DSNDB01  SPT01    001 DB1HC           3        36        27 ***
 BAB312 DSNDB01  SPT01    001 DB2HC          21        40        13 *
 BAB312 DSNDB06  DSNADH01 001 DB1HC           3        43        17 **
 BAB312 DSNDB06  DSNADH01 001 DB2HC          23       221        37 ****
 BAB312 DSNDB06  DSNATX01 001 DB2HC          13       145        30 ***
 BAB312 DSNDB06  DSNATX02 001 DB1HC          12       155        40 ****
 BAB312 DSNDB06  DSNATX02 001 DB2HC         139        98        17 **
```

Figure 53. Volume Page Sets (PSVOLPS)

6. Press **PF3** to return to EZDSHAR; then select the **Data Sharing Wizard**.

7. There are several paths you could take on this panel, but first look down at the **Page Set Considerations** section. This provides another way to get to the Volume I/O data you just looked at, but we are now going to select the option to **Check GBP-DEP per Member** to see the level of sharing, as shown in Figure 54.

Check GBP-DEP per Member

```
17SEP2003 16:01:31 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSDEP==========(DBGHC====*=======)17SEP2003==16:01:30====MVDB2====D====2
 DB2      MVS         GBP   Local  Remote Log Recs  Ckpts To  Mins. To   Delete
 Target   System      DEP R/W Int R/W Int  To Ckpt PCLOSE(N) PCLOSE(T)    Names
 DB1HC    SYSC          4       4       4    50000         5        10        0
 DB2HC    SYSC          4       4       3    50000         5        10        8
```

Figure 54. Data Sharing Wizard GBP-DEP/Member (WZDSDEP)

This shows a summary of how many GBP-dependent page sets there are in the group per DB2 member, and includes the key ZPARM values that affect how long a page set remains in this status.

8. Tab the cursor to the column header, **Mins to PCLOSE(T)**, and press **PF1** to get field help on this value, as shown in Figure 55.

   Many field help panels, like this one, contain tuning tips in addition to the field definition.

Tuning Tips

```
17SEP2003 16:01:31 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSDEP==========(DBGHC====*=======)17SEP2003==16:01:30====MVDB2====D====2
 DB2      MVS         GBP   Local  Remote Log Recs  Ckpts To  Mins. To   Delete
 Target   System      DEP R/W Int R/W Int  To Ckpt PCLOSE(N) PCLOSE(T)    Names
 DB1HC    SYSC
 DB2HC    SYSC             Help       Pseudo-Close Timer Parameter       Help
                           Command ==>                        Scroll ==> CSR
                           ------------------------------------------------

                           This value lists the amount of time, in minutes,
                           that must elapse before a data set can be a
                           candidate for pseudo-close (QWP1TMR).

                           ZPARM name: PCLOSET in DSN6SPRM

                           Tuning Tip: The PCLOSEN and PCLOSET parameters are
                                       associated with pseudo-close. PCLOSEN
                                       defaults to 5 system checkpoints and
                                       PCLOSET defaults to 10 minutes. There
                                       is a trade off in setting these
                                       parameters. If these values are set
                                       too high, data sets may remain
                                       GBP-dependent for longer than
                                       necessary and incur unnecessary
                                       performance overhead. If these values
```

Figure 55. Field Help

9. Press **PF3** to return to the Data Sharing Wizard (WZDSHAR) and select the option to **Check GBP-DEP by GBP/PS**.

Per Group Buffer Pool

```
17SEP2003 16:18:16 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSBPGBPZ=========(DBGHC====*=======)17SEP2003==16:18:15====MVDB2====D====2
 Bfrpl   DB2       Nr.    GBP        Local         Remote       VP        VP
  ID     Target    PSs Dependent  R/W Interest  R/W Interest  Current  Changed
 BP00    DB1HC      56         2             1             1      200        0
 BP00    DB2HC      72         2             1             1       88        1
```

Figure 56. Buffer Pool Page Set GBP-DEP Summary (PSBPGBPZ)

This view summarizes the same data, also for the whole group, but now organizes it per group buffer pool and member.

10. Select one pool (**Bfrpl ID**) to see a list of all the open page sets in that pool for all targets.

11. Press **PF3** to return to PSBPGBPZ and then hyperlink on the **GBP Dependent** column to list only the GBP-dependent page sets in that pool (PSGBP), as shown in Figure 57.

Open Page Sets in One Pool

```
17SEP2003 16:19:22 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSBPGBPZ=PSGBP===(DBGHC====*=======)17SEP2003==16:18:15====MVDB2====D====4
 ------Page Set-------  DB2          No. GBP Local    Remote      VP        VP
 Database Object   Prt Target   Ty Usrs Dep Interest Interest  Current  Changed
 DSN8D51A DSN8S51E 001 DB1HC    PS    0  Y  R/O      R/W             1        0
 DSN8D51A DSN8S51E 001 DB2HC    PS    0  Y  R/W      R/O             0        0
 DSN8D51A DSN8S51P 001 DB1HC    TS    0  Y  R/W      R/O             2        0
 DSN8D51A DSN8S51P 001 DB2HC    TS    0  Y  R/O      R/W             0        0
```

Figure 57. Page Set GBP-DEP Status (PSGBP)

You can not only see which member(s) is GBP-dependent, but also which member(s) has Read/Write Interest and how many pages from that page set are cached in each member's local buffer pool.

Analyze Global Lock Contention

One of the most important issues in data sharing is to control global lock contention, since it not only causes the usual problems of application availability you deal with in one DB2, but can significantly degrade performance in a data sharing group as well.

To analyze global lock contention:

1. Press **PF3** to return to the Data Sharing Wizard (WZDSHAR) and select **Lock Contention Wizard**.

   The Global Lock Wizard (WZLKGOPT) is displayed, as shown in Figure 58.

Analyze Contention for a Group

```
17SEP2003 16:20:50 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZLKGOPT=========(DBGHC====*=======)17SEP2003==16:20:49====MVDB2====D====1
  ** LOCK WIZARD - GROUP **              Target Values... DB1HC

  . Check Member Contention?                                Interval   Session
    (& Select any Member)                Global Locks....      243     12900

  . Review History and set TIME?         Global Suspends.       22      1025
    (If Current Interval OK)

  . Any Gross Locks? (2 hrs)             GrossLocks......        0         0
    (Reduced Concurrency)

  . List Group Lockouts?                 Timeouts........        0         1
    (Contention Victims)                 Deadlocks.......        0         3

  . Which Resources Involved?
    (Data Hot Spots)

  . Compatible Workloads?
    (Connections Involved)

  Analyze Plans In Lockouts?
  . Global Blockers/Waiters
  . Blocker Plans
  . Waiter Plans
```

Figure 58. Global Lock Wizard (WZLKGOPT)

The Global Lock Wizard helps you step through the analysis of lock contention in DB2 for a data sharing group. It allows you to look at current status or choose an earlier time interval, perhaps one that a user of your system has complained about.

A history of the most important symptoms of lock problems—timeouts and deadlocks—is available, as well as information on system considerations and statistics that can point out potential causes of problems.

2. Select **Check Member Contention?**.

   This view, shown in Figure 59, enables you to see the key indicators for all of the members together, allowing you to identify quickly whether or not there are any global contention issues to analyze. The counts shown are for the time since DB2 started.

Check Member Contention

```
17SEP2003 16:21:53 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZLKGOPT=WZLKGMEM(DBGHC====*=======)17SEP2003==16:20:49====MVDB2====D====2
 DB2      MVS      Total    Local    Global         % of Group   Global False
 Target   System   Lockouts Suspends Suspends ..... 0....50..100  Locks  Cont.
 DB1HC    SYSC            4       42     1025  53.9 *******       12900    437
 DB2HC    SYSC            6       85      877  46.1 ******        27809    348
```

Figure 59. Lock Wizard Global Members (WZLKGMEM)

3. From here, you can hyperlink on any one DB2 to analyze its contribution to (or victimization by) global lock contention, as shown in Figure 60.

Member Lock Detail

```
17SEP2003 16:23:49 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZLKGOPT=WZLKGCON(DBGHC====DB2HC===)17SEP2003==16:20:49====MVDB2====D====1
  Global / Local Contention
                              Interval          Session
  Lockouts
   Timeouts                          0                3
   Deadlocks                         0                3

  Indicators
   % Global Contention            5.6              1.5
   . If High - Tune GBP-DEP

   % False Contention            23.3             39.7
   . If High-Tune CF (MVMVS)

  Global Lock Activity
   XES Sync Requests               239            27809
   XES Async Requests                0                7
   IRLM Suspensions                 23              513
   XES Suspensions                   0               16
   False Suspensions                 7              348
   . More Info...
  Local Lock Activity
   Lock Requests                 21959           121627
   Lock Suspensions                  0                4
   Latch Suspensions                10               57
   . More Info...
```

Figure 60. Lock Wizard Global/Local Contention (WZLKGCON)

This view provides the information to analyze both global and local lock contention for a selected member. Besides the most critical statistics, both for the current interval and since DB2 startup, the two key indicators of % global contention and % false contention are calculated for you. Thresholds are defined to highlight any value that exceeds the recommended value. Place the cursor on the **% Global Contention** header or fields to see an explanation of the calculation and what it means.

4. Press **PF3** to return to the Lock Wizard - Group panel (WZLKGOPT) and select **List Group Lockouts?** to see a list of the latest timeouts and deadlocks that have occurred in all the members of the group.

   The *Global Contention* flag on the right is set to YES when the conflict occurred between threads running on different members, as shown in Figure 61.

Group Lockouts Showing Global Contention

```
17SEP2003 16:25:20 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKEVSSI==========(DBGHC====*=======)17SEP2003==16:25:20====MVDB2====D====7
 Date / Time    Lockout   Victim   Victim   Victim   Victim   Victim   Global
 -------------- Type      Member   Plan     AuthID   Connect  CorrName Cont.
 17SEP-16:12:37 DEADLOCK  DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK1   YES
 17SEP-16:10:18 TIMEOUT   DB1H     RXDB2    BOLLAA2  DB2CALL  DMRTMO2   YES
 17SEP-16:10:15 TIMEOUT   DB2H     RXDB2    BOLLAA2  DB2CALL  DMRTMO3
 17SEP-16:06:43 TIMEOUT   DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK3
 17SEP-16:06:42 DEADLOCK  DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK1   YES
 17SEP-15:45:46 DEADLOCK  DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK1   YES
 17SEP-15:45:26 TIMEOUT   DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK3
```

Figure 61. Global Lockout Events (LKEVSSI)

From here, you can drill down for more information on the resources involved in a specific event, and then to a detail view of each lock holder or waiter.

Tip: If this is a distributed thread, scroll right to see the additonal workstation identifiers, as well as some that are specially formatted for SAP.

5. Press **PF3** to return to the Lock Wizard - Group panel (WZLKGOPT) and select **Which Resources Involved?** to analyze resource conflicts in the group, as shown in Figure 62.

Group Resource Conflicts

```
17SEP2003  16:27:13 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ==========(DBGHC====*=======)17SEP2003==16:27:12====MVDB2====D====2
 --Resource Name--  Total           % Total                          Global
 Database Object    Conflicts       0...50..100   PAGE   ROW INDEX  Conflicts
 DSN8D51A DSN8S51E          8  72.7 ********         8     0     0          5
 DSN8D51A DSN8S51P          3  27.3 ***              0     3     0          3
```

Figure 62. Lockout Resource Summary (LKRESZ)

The first view summarizes all conflicts by table space / index space, so that you can quickly identify the objects with the most contention. The count on the right shows how many conflicts exist between members (global).

6. Hyperlink on a **resource name** showing several conflicts to see a breakdown of these conflicts by specific resource, down to a page or row level (LKRESNRZ).

   With this view, hot spots in your tables are immediately visible, as shown in Figure 63.

See Hot Spots

```
17SEP2003  16:28:44 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===LKRESNRZ(DBGHC====*=======)17SEP2003==16:27:12====MVDB2====D====1
 --Resource Name-- Resource   Resource  Total           % Total     Global
 Database Object   Number     Type      Conflicts       0...50..100 Conflicts
 DSN8D51A DSN8S51E 0000001200 DATAPAGE          8  72.7 ********            5
```

Figure 63. Lockout Resource Number Summary (LKRESNRZ)

7. Hyperlink on either the **resource name** or the **resource number** to view a list of each lockout event that involved this resource (LKRESD), as shown in Figure 64.

Each Event for This Resource

```
17SEP2003  16:30:21 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===LKRESD==(DBGHC====*=======)17SEP2003==16:27:12====MVDB2====D====8
 --Resource Name-- Resource   Resource   Time   Lockout  Blocker  Waiter   Gbl
 Database Object   Number     Type     -------- Type     PlanName PlanName Con
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:12:37 DEADLOCK RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:10:18 TIMEOUT  RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:10:18 TIMEOUT  RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:10:15 TIMEOUT  RXDB2    RXDB2
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:06:43 TIMEOUT  RXDB2    RXDB2
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:06:42 DEADLOCK RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 15:45:46 DEADLOCK RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 15:45:26 TIMEOUT  RXDB2    RXDB2
```

Figure 64. Lockout Resource Conflict Detail (LKRESD)

This view helps you quickly determine which plans are involved in the contention and whether or not the problem was occurring only at a particular time, perhaps because of an application affinity problem.

8. Press **PF3** to return to the Lock Wizard - Group panel (WZLKGOPT) and select **Global Blockers/Waiters?** to see which plans are involved in the lockouts, as shown in Figure 65.

Which Plans Involved?

```
17SEP2003  16:31:40 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKBWZSSI=========(DBGHC====*=======)17SEP2003==16:31:37====MVDB2====D====3
 Blocker  Blocker  Waiter   Waiter   Timeout Deadlock        % Conflicts   Gbl
 PlanName Member   PlanName Member   Involv.  Invovl.   .... 0....50..100  Con
 RXDB2    DB1H     RXDB2    DB2H           1        3   36.4 ****            4
 RXDB2    DB2H     RXDB2    DB1H           1        3   36.4 ****            4
 RXDB2    DB2H     RXDB2    DB2H           3        0   27.3 ***             0
```

Figure 65. Lockout Global Blocker Waiter Summary (LKBWZSSI)

This view lists a summary of blocker/waiter plans and systems. You can identify conflicting plans across multiple data sharing DB2 members. Again, the list of events for a particular combination is available with a hyperlink, so you can quickly check to see if there are any application scheduling problems.

Tune Group Buffer Pools

After global locking, the next most important area of data sharing tuning is to determine whether or not the group buffer pools are the right size and have the correct ratio of directory to data entries to support your workload, based on the amount of inter-DB2 sharing that is occurring.

If any of these resources is lacking, overhead increases in the group buffer pools, the coupling facility, and the local pools. It can also cause unnecessary I/O.

To tune the group buffer pools:

1. Press **PF3** to return to the Data Sharing Wizard (WZDSHAR) and select **Review Group (Session)** to see an overview of key statistics about

   - Global Contention
   - Group buffer pool performance
   - GBP-dependent page sets
   - Coupling facility activity (castouts, failures)

Data Sharing Member Overview

```
17SEP2003  16:33:40 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =WZDSGMEM=========(DBGHC====*=======)17SEP2003==16:33:40====MVDB2====D====2
 DB2      MVS      Global   Total           Read Hit %    GBP
 Target   System   Cont. %  Lockouts  ..... 0...50..100   DEP Castouts Failures
 DB1HC    SYSC         3.76        4   14.0 **              1        4        0
 DB2HC    SYSC         1.57        6   22.2 **              1       23        0
```

Figure 66. Data Sharing Wizard Group Members (WZDSGMEM)

This view shows you some of the key indicators per member. This allows you to identify quickly whether or not there are any performance issues to analyze. The counts shown are for the time since DB2 was started.

From here, you can hyperlink on any one DB2 to see all the member statistics for both the current interval and the session data since DB2 startup. Or you can return to the first panel to follow some of the analysis paths.

2. Press **PF3** to return to the Data Sharing Wizard (WZDSHAR) and select **Check GBPs** to access the GBP analysis section of the Data Sharing Wizard.

   This decision panel provides options to analyze GBP size and the ratio of directory to data entries, as shown in Figure 67.

GBP Analysis

```
17SEP2003  16:35:20 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSBOPT=========(DBGHC====DB******)17SEP2003==16:35:19====MVDB2====D====1
  ** DATA SHARING WIZARD - GBPs          Group GBP Values

  Check Totals per GBP
    (Select GBP for Detail)                                 Interval   Session

  . GBP Size Too Small?                  Read Hit %......       0.0       6.2
    (Low Hit% / Cache Full)              Miss-Cache Full.         0         0
                                         Curr. Chngd Pgs.         0

  . Too Few Directory Entries?           Dir.Reclaims....         0         0
    (Reclaims Cause XI/DASD Reads)       XIs/Dir.Recl....         0         0

  . Too Few Data Entries?
    (Castouts More Frequent)             Castouts........         6        95
    (Castout Too Slow)                   Write Fail-Stor.         0         0
```

Figure 67. Data Sharing Wizard GBP Options (WZDSBOPT)

There are three diagnostic paths here, but, as an example, we are going to follow the path to analyze directory entries. Even if the pools are large enough, a lack of directory entries (used to register each page) can cause problems.

The key indicators on the right are there to help you decide whether or not you need to do additional analysis by following one or more paths. On this panel, all of these values are for the whole group, summarized for all GBPs.

Possible symptoms of too few directory entries are

- The occurrence of directory reclaims so that new pages can be registered
- The even worse consequence—that cross-invalidations of pages in the members' local buffer pools are occurring because of these directory reclaims

If one of these indicators is greater than 0, the field is highlighted in red.

3. Hyperlink on **Too Few Directory Entries** to see a tabular list of all defined group buffer pools, as shown in Figure 68.

GBP Group Overview

```
17SEP2003  16:36:09 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =WZDSGBR==========(DBGHC====*=======)17SEP2003==16:36:09====MVDB2====D====9
  GBP      Curr.  Pend.    Dir.    Data   Directory  XI from   XI Read Read Hit
 Name      Ratio  Ratio  Entries  Entries  Reclaims Dir.Recl.    Miss     Ratio
 BP0           5      5      942      187         0         0       3      6.2
 BP1                          0        0         0         0       0      0.0
 BP2                          0        0         0         0       0      0.0
 BP4                          0        0         0         0       0      0.0
 BP5                          0        0         0         0       0      0.0
 BP9                          0        0         0         0       0      0.0
 BP11                         0        0         0         0       0      0.0
 BP32K                        0        0         0         0       0      0.0
 BP32K9                       0        0         0         0       0      0.0
```

Figure 68. Data Sharing Wizard GBP Directory Entries (WZDSGBR)

Now you can see each group buffer pool with the current definitions, the two key indicators we saw before for all pools (Directory Reclaims and XI from Dir.Recl. columns), and some additional related statistics.

4. From here you can select a single GBP for further analysis, as shown in Figure 69.

GBP Directory Entries (Group)

```
17SEP2003  16:37:11 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSGBRD=========(DBGHC====DB******)17SEP2003==16:37:11====MVDB2====D====1
  GBP Directory Entry Analysis - Detail  BP0

                                        Interval           Session
  Reclaims for Directory Entries?              0                 0
    (GBP Page/Dir Reused)

  Directory Reclaims Causing XI?               0                 0
    (Local VP Pages Invalidated)

  Also Increasing DASD Reads?
    . Check Members for:
      * XI Miss ==> DASD Reads

  GBP Hit Ratio Low?
    . Check Members for:
      * Low GBP Hit Ratio

  Definitions
    Total Size (4K Blocks)                  256
    Directory Entries                       942
    Data Entries                            187
    Current Ratio                           5
    Pending Ratio                           5
```

Figure 69. Data Sharing Wizard GBP Directory Detail (WZDSGBRD)

This analysis panel provides details to help you determine whether or not a group buffer pool may have too few directory entries to support its part of the data sharing workload. It addresses the main issue—whether directory reclaims are causing cross-invalidations (XI) and probably increasing I/O.

In this panel, you now see the two key indicators again, but both as interval (current activity) and session (total since DB2 startup) counts.

The answer to the additional question of whether or not this is increasing DASD reads can only be seen by looking at statistics per member instead of at the group level.

5. Hyperlink on **Check Members for XI Miss** to see data sharing session activity counts per member for this group buffer pool, as shown in Figure 70.

Counts per GBP and Member

```
17SEP2003  16:39:04 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSGBSA=========(DBGHC====*=======)17SEP2003==16:39:02====MVDB2====D====2
  GBP    DB2       Read  XI Read  NF Read  Changed   Clean Sync Read Async Read
 Name    Target   Hit %    Miss     Miss    Writes  Writes     Total       Total
 BP0     DB1HC     14.0       3       40       12       0        50           0
 BP0     DB2HC     22.2       1       13       20       0        18           0
```

Figure 70. Data Sharing Wizard GBP Size Activity (WZDSGBSA)

The XI Read Miss column now shows whether or not any members had to do additional I/O to read in pages lost through reclaims and cross-invalidation. Non-zero counts are highlighted. From here, you can also hyperlink on a GBP to see interval and session counts for that GBP.

You have seen a few of the most important areas for data sharing monitoring. You have used a Single System Image context to enable you to monitor all members of a group, both individually and summarized, and to pull all the relevant data together. Now you have the tools to master the new and complex data sharing performance issues.

Chapter 4. Tuning an Application with Trace

These scenarios teach you how to navigate easily through the MAINVIEW for DB2 trace setup panels and the displays of trace data, and acquaint you with the trace print utility.

In this practice session, you

1. Start an application trace and review the available options.
2. Review tips on running your tests with trace.
3. Look for application problems using the various trace displays.
4. Print a trace report for offline review.

Note: To complete the first exercise, you must have authorization to start detail traces. Contact your system administrator if you do not have authorization. If SAF security is in use, the resource name is “prefix.ssid.BBI.target.TRACE.D” or “prefix.ssid.BBI.target.TRACE.ALL”. If USERID security in BBPARM is in use, the parameter to be specified is DB2TRACE=D or ALL.

This practice session takes approximately two hours to complete.

Start an Application Trace

To start an application trace, begin by checking the current traces:

1. From the Primary Option Menu, select the **TRACES** option.

   ```
   OPTION ===> 4
   ```

   This panel lists all the current traces, as shown in Figure 71. They may be active and collecting data from DB2 (STATus is ACTV), or already complete but not yet purged (STATus is COMP). We will return here later to view your own trace.

Current Traces

ST Command

```
BMC Software ------------------- CURRENT TRACES -------------  PERFORMANCE MGMT
COMMAND ===>                                                  TGT ===> DB2G
                                      INPUT    INTVL ==> 3      TIME --  14:31:36
COMMANDS: ST (START APPLICATION TRACE), HT (HISTORY TRACES), TYPE
LC CMDS:  S (SELECT), W (SHOW),      M (MODIFY), I (SWITCH), Z (STOP)
          P (PURGE),  R (REPLICATE), H (HELP),   Q (QUIESCE LOGGING)
LC  PARM     TITLE                     USER ID  TARGET  TYPE AREA  STAT  LOG
    SUMMARY  DAILY ACCOUNTING TRACE    CIR11    DB2D    SUM  WKLD  ACTV  ACT
    DETAIL   TRACE OF APDT001T         PWW1     DB2D    DET  WKLD  ACTV
    BIGELAP  ELAPSED OVER 10 SEC       PWW1     DB2D    SUM  WKLD  ACTV
```

Figure 71. Current Traces Application

2. Transfer to START APPLICATION TRACE.

   ```
   COMMAND ===> ST
   ```

   You must be authorized to start a trace and to specify certain options. See your system administrator for the trace privileges you have. If you cannot start a trace, just browse these instructions and then go to “Look for Application Problems” on page 75 to view an already active trace.

Specify Options

On the Start DB2 Trace Request panel, shown in Figure 72, you can specify various options for your trace. Many traces can be started using just this first panel. If you want to review additional options, they are available on three more panels that are accessed much like DB2I SPUFI options.

Start Trace

Using Defaults

```
BMC Software ---------------  START DB2 TRACE REQUEST -------- PERFORMANCE MGMT
COMMAND ===>                                                   TGT==> DB2G

PARM     ==>          (Trace identifier)     START ==>           (hh:mm:ss)
TYPE     ==> S        (S-Summary,D-Detail)   STOP  ==>           (hh:mm:ss/#min)
STORAGE  ==> 1000K    (Display buffer size)  WRAP  ==> YES     (Y/N wrap buffer)
LOGTRAC  ==> N        (Y/N log trace)        RST   ==> HOT     (HOT,PUR,QIS)
TITLE    ==> DB2 APPLICATION TRACE

Specify Selection Criteria:
DB2PLAN  ==>
DB2AUTH  ==>
DB2CONN  ==>
DB2CORR  ==>
DB2LOC   ==>
DB2PKG   ==>
CONNTYPE ==>

Specify additional trace options:    (*   = processed)
Exception Filters          ==> N  (Y/N)
Detail Trace Options       ==> N  (Y/N)
Trace Log Data Set Options ==> N  (Y/N)

                                        Press ENTER to process; END to cancel
```

Figure 72. Start DB2 Trace Request Panel

1. Define a trace using mostly defaults.

   a. `PARM ==> id`

      You can specify any name as an ID, but try to make it descriptive. For example, use your initials or an acronym for the application being tested, plus a number to identify the test: JNL003, ABCTEST1, ABC2IO.

   b. `START ==>`

      Leave blank to start the trace immediately.

   c. `TYPE ==> D`

      A Detail trace collects the DB2 accounting record and additional events (DB2 performance trace IFCIDs) per thread. The default includes the basic start and end events, plan allocation data, exceptions (like timeouts), sorts, and all the SQL statements. This can be modified on a later panel.

   d. `STOP ==> 10`

      This traces for 10 minutes and then stops collecting data. Even if you decide not to log a trace, the data is available for display until the trace is purged.

   e. `STORAGE ==> 1000K`

      Use the site default size for the storage buffer (used for online display).

   f. `WRAP ==> Y`

      Use the default to wrap the data in the STORAGE buffer if it fills up.

   g. `LOGTRAC ==> Y`

      Specify Y to request trace logging. This allocates a VSAM log for this trace. You can recall the data for online display or print reports until you decide to delete the data set.

   h. `RST ==> HOT`

      Use the default to restart the trace automatically without loss of data if DB2 goes down and up while you are tracing.

   i. `TITLE ==> user-specified title`

      This field is filled in with the default, but you should specify a title that will help you later to identify the contents of this trace.

   j. `DB2AUTH ==> userid,SYSOPR`

      Specify your user ID to trace your own tests. Add SYSOPR to trace prefetch reads. You can also specify other selection criteria. For a detail trace, you must specify DB2PLAN or DB2AUTH to limit DB2 tracing. This is subject to DB2 restrictions (1 plan / 8 authids, or vice versa).

      Note: If you qualify by plan, prefetch read I/O events cannot be captured.

2. Request the additional trace options to review the other panels.

```
Exception Filters          ==>  Y
Detail Trace Options       ==>  Y
Trace Log Data Set Options ==>  Y
```

3. Press **Enter** to view the next panel.

4. Review the Exception Filters panel, shown in Figure 73, but leave it empty.

Narrowing the Trace

```
BMC Software --------------- DB2 TRACE EXCEPTION FILTERS ----- PERFORMANCE MGMT
COMMAND ===>                                                  TGT -- DB2G

Specify Exception Filters:
ELAP    =>          GETPAGE  =>          MAXLOCK  =>        SQLDDL   =>
CPU     =>          PGUPD    =>          LOCKTBL  =>        SQLDYN   =>
ABORT   =>          READIO   =>          INCRBIND =>        SQLCTL   =>
UIDCOM  =>          LOCKSUSP =>          SQLSEL   =>        SQLFETCH =>
GETRIO  =>          LOCKESCL =>          SQLUID   =>        SQLTOT   =>
RLF     =>          TIMEOUT  =>          RIDFAIL  =>        CLAIMDR  =>
PWAITIO =>          PWAITLK  =>          PWAITPF  =>        PWAITOT  =>
PFREQS  =>          PFREADS  =>          HPFAILS  =>        PRLLGRP  =>
PRLLRED =>          PRLLFALB =>
ELAPDB2 =>          CPUDB2   =>
```

Figure 73. DB2 Trace Exception Filters Panel

Specifying filters causes thread accounting records that do not meet the qualification to be discarded. The value can be a maximum (n) or a minimum (<n). For example, specifying ELAP ==> 10 only keeps threads with an elapsed time greater than 10 seconds. This is very useful when you are looking for poorly performing applications in an existing DB2 workload.

Note: If you specify several filters, they are ORed. A trace record is retained if any one of the comparisons is valid.

5. Press **Enter** to view the next panel.

6. Review the Detail Trace Options panel, shown in Figure 74.

   Note: You should review the recommendations in Volume 2 of the *MAINVIEW for DB2 User Guide* before executing detail traces of long-running threads.

Adding Detail Events

```
BMC Software --------------- DETAIL TRACE OPTIONS ------------ PERFORMANCE MGMT
COMMAND ===>                                                    TGT -- DB2G

Specify additional events:
    SQL         ===> Y  (Y/N)
    SCANS       ===> N  (Y/N)
    I/O         ===> N  (Y/N)
    LOCKS       ===> N  (Y/N)
    DDF         ===> N  (Y/N)
    DDFVTAM     ===> N  (Y/N)

Specify event compression:
    GROUP SQL   ===> Y  (Y/N)

Specify data collection buffer options:
    TRSIZE      ===> 400K     (Trace buffer size)
    TRBUFF      ===> 20       (# of trace buffers)
```

Figure 74. Detail Trace Options Panel

`TRSIZE ==>` `(value shown is the default for your site)`

This is the size of a data collection buffer. Without logging, the data collected for one thread is limited to two buffers. If you are tracing long-running applications, you might need to increase the size. With logging, multiple buffers can be written per thread and combined automatically when recalled online or printed.

`TRBUFF ==>`

You might need to increase this value to trace more concurrent threads or to provide multiple buffers for the logging of long-running applications. The recommended number is three or more times the number of concurrent threads to be traced.

Note: Volume 2 of the *MAINVIEW for DB2 User Guide* has additional recommendations that can help you trace special situations like capturing part of a long-running thread. See the chapter on “Using a Trace” and Appendix C, “Recommendations for Detail Traces of Long-Running Threads” in that book.

`GROUP SQL ==>` **`Y`**

Y groups many consecutive identical SQL statements together to save space and make the event trace easier to read; for example, combine many FETCHes.

7. Specify the additional DB2 events you want to trace.

```
SQL      ==>  Y      Default is Y for standard application tuning
SCANS    ==>  Y      Default is N, specify Y this time
I/O      ==>  Y      Default is N, specify Y this time
LOCKS    ==>  N      Default is N, leave as is - very expensive
DDF      ==>  N      Default is N, needed only for distributed work
DDFVTAM  ==>  N      Default is N, needed only for DDF VTAM analysis
```

   Each of the other groups of events adds additional overhead. You can specify any combination; for example, SQL and I/O but no SCANS.

8. Press **Enter** to view the next panel.

9. Review the Trace Log Data Set Options panel, shown in Figure 75, but leave the defaults.

Logging the Trace

```
BMC Software -------------- TRACE LOG DATA SET OPTIONS ------ PERFORMANCE MGMT
COMMAND ===>                                                  TGT -- DB2G

Number of Logs   ===> 1          (# data sets; >1 for auto switch when full)
First Log DSN    ===>
                  Low level qualifier of DSN must be V01
                  Blank for default: CIR7.DB1D.BLANK.mmmdd.Thhmm.V01
                  Names without quotes will be prefixed with CIR7

Overwrite logs   ===> Y    (Y/N) (Action when all logs used)
Archive PROC     ===>            (Blank for none/PROCLIB member name)
Log switch time  ===>            (HH:MM that a log switch is requested)

Disposition      ===> NEW  (OLD/NEW)  If NEW, specify options below:

 Volumes         ===> (V00001,V00002,V00003)
 Primary CYLS    ===> 5               SMS Storage Class    ===> SMSSTOR
 Data DSN Suffix ===> D1              SMS Data Class       ===> SMSDATA
                                      SMS Management Class ===> SMSMGMT
```

Figure 75. Trace Log Data Set Options Panel

a. `Number of Logs ==>` **`1`**

   Multiple logs are usually needed only for continuous system traces for workload history.

b. `First Log DSN ==>`

   Leave this blank to take the generated default. You must be authorized for dynamic allocation of a trace log. See your system administrator. If you are not authorized, there is a batch job (JXT011) to preallocate a log data set. Then type the name here and change DISPOSITION to OLD.

c. `Overwrite Logs ==>` **`Y`**

   Y allows the latest trace data to be kept if it doesn't all fit in the log. N keeps the earliest trace data by quiescing the trace when full.

d. `Archive PROC ==>`

   Leave blank. Not needed for simple single-log traces.

e. `Log Switch Time ==>`

   Leave blank. Not needed for simple single-log traces.

f. `Disposition ==>` **`NEW`**

   Leave NEW unless you had to preallocate a log.

g. `Volumes ==>`

   This should be filled in with the default volume(s) for your site. If not, specify a volume the MAINVIEW for DB2 product address space (BBI-SS PAS) is allowed to use.

h. `Primary Cyls ==>`

   Use the default.

10. Specify SMS values if necessary in your shop and defaults are not set.

```
SMS Storage Class     ==>
SMS Data Class        ==>
SMS Management Class  ==>
```

11. Press **END** to process the options and return to the first panel.

Activate the Trace

All options are now specified for your trace. The trace options are set to *****. If you want to drop the related options you specified, change the ***** to **N**. To view them again, change the ***** to **Y**.

When all options are ***** or **N**:

1. Press **Enter** to submit the trace request.
2. Press **PF3** to return to the CURRENT TRACES panel.
3. Press **Enter** until the status of your trace changes to ACTV.

Data can now be collected. Enter some activity to be traced.

- If the status changes to INV (invalid), there was an error in your request that was not found in the preliminary syntax checking. An example of this kind of error would be a trace log data set allocation error because no space was available on the specified volume. You can see the detailed error messages on the Journal Log (press **PF5** to view).
- If the status changes to QIS (quiesced), the target DB2 is not up.

Review Tips on Tracing Tests

There are many different scenarios for testing. Here are some hints on tracing a few of the most common tests.

- Testing your new application during development

  1. Qualify the trace by your own AUTHID. DB2 trace overhead is only incurred for the tests of your application. Depending on the number of users of the MAINVIEW for DB2 trace in your test DB2 system, you may be able to keep your trace request active through several test iterations, consolidating them on one trace log. (Only four detail traces can be active at one time.)

  2. BIND your program after the trace is started. This captures the text and EXPLAIN data of all static SQL statements in your trace output for reference when analyzing performance. EXPLAIN=YES is not required.

  3. If you don't set an automatic stop time when requesting your trace, don't forget to stop it when you have completed testing (use the Z line command in the CURRENT TRACES option). If you have logged the trace data, you should also purge the trace when complete. You can still browse and print the data from the log (HISTORY TRACES option). Otherwise, analyze the data from the online buffers and purge the trace when you are done.

- Analyzing the performance of an existing application

  1. If you have SQL Explorer, RxD2/FlexTools, or a similar tool, you can qualify the trace by PLAN.

  2. Set automatic start and stop times to cover a time span in which you expect sufficient activity.

  3. If the application usually runs well with only a few occurrences of poor performance, specify exception filters to save just those that you need to analyze. For example, select only those with high elapsed or CPU times, or with many GETPAGE requests or I/Os.

- Improving the performance of a bad SQL statement

  1. You may have identified a poorly performing SQL statement and now want to try out several different variations in the syntax to determine which is best. If you have RxD2/FlexTools or a similar tool, you can modify and execute the statement directly from the source while in ISPF edit. Otherwise, make the statement executable from SPUFI.

  2. Start the trace qualified by your AUTHID.

  3. Modify and execute each variation as dynamic SQL. You want to force the thread to terminate so an accounting record will be produced. This is done automatically with RxD2. With SPUFI, you must exit each time to terminate the thread.

  4. The trace automatically captures the SQL text, EXPLAIN data (with cost factor), and the accounting record and SQL performance statistics.

     You now have all variations captured together in one trace for easy comparison.

- Comparing test to production

  1. Save the detail trace log from the last test run. Run a short detail trace in production after cutover to compare performance. You can either print batch reports or browse both trace logs in split screen mode.

Look for Application Problems

Now it is time to become acquainted with the trace displays and learn how to use them for application tuning.

There are two options on the Primary Option Menu that display trace data:

- Option 4, TRACES

  ```
  OPTION ===> 4        TRACES - Current Application Traces
  ```

  This option lists all currently active or complete trace requests. You have already viewed this option when starting your trace and checking that it started correctly. From this option you can see the trace data as it is being collected. And even after the trace is complete, it stays available here until you purge the trace.

  Trace data is posted to the display buffer only when the accounting record is written. If you are tracing a longer running thread (detail), you can view the detail events as they occur with the UTRAC display. (Select the current USERS analyzer display, line select the detail display (DUSER) for your thread, and expand to UTRAC.)

  When you trace long-running threads, logging is recommended so that data is not lost because of buffer shortages. The data should also be viewed from the logs instead of the buffers (see next option).

  Press **PF3** to return to the Primary Option Menu.

- Option 5, HISTORY TRACES

  ```
  OPTION ===> 5      HISTORY TRACES - Historical Trace Data Sets
  ```

  Traces that are logged are also always accessible through this option that lists all known trace log data sets. You can view your trace when it is running, after it is complete, and even after you have purged the original trace request—as long as it is worthwhile to keep the data set. This makes it easy to compare different tests, even a month or two apart, without keeping stacks of paper.

  From the log you can recall the data online or print selected reports. The trace log data sets are displayed in descending order by date and time, as shown in Figure 76, so you can easily find a newly created log. If you are looking for an older log, you can sort the display by any of the columns.

Logged Traces

```
BMC Software ----------------- HISTORY TRACES  --------------  PERFORMANCE MGMT
COMMAND ===>                                                  TGT ===> DB2G
                                          TIME --  09:36:34  SCROLL ===> CSR
COMMANDS: SORT, LOCATE, NEW, STOP, START, TYPE
LC CMDS:  S (SELECT), W (SHOW), P (PRINT), D (DELETE), E (RESET)
          V (VERIFY), N (NEW), A (ARCHIVE), F (FREE)

DIRECTORY:    CIR4.LL1X.TRACEDIR
ENTRIES USED: 1,209  FREE:   201
                                                              SCROLL RIGHT >>>
LC  DATE------TIME  TRACEID  TITLE                    USERID   TGT   STAT  ACTV
    02/09/29 22:00  LEOTST01 LEOS DETAIL TRACE       CIR4     DB2G  INV
    02/09/11 21:00  DET1     WORKLOAD DETAIL 1       CIR2     DB2G  USED  READ
    02/09/01 00:00  THRDHIST THREAD HISTORY          BABUSERS DB2G  UPDAT WRIT
```

Figure 76. History Traces Application

Figure 77 summarizes many of the ways you can navigate among the trace displays accessed from either Current Traces, Option 4, or History Traces, Option 5. It is included here for your reference.

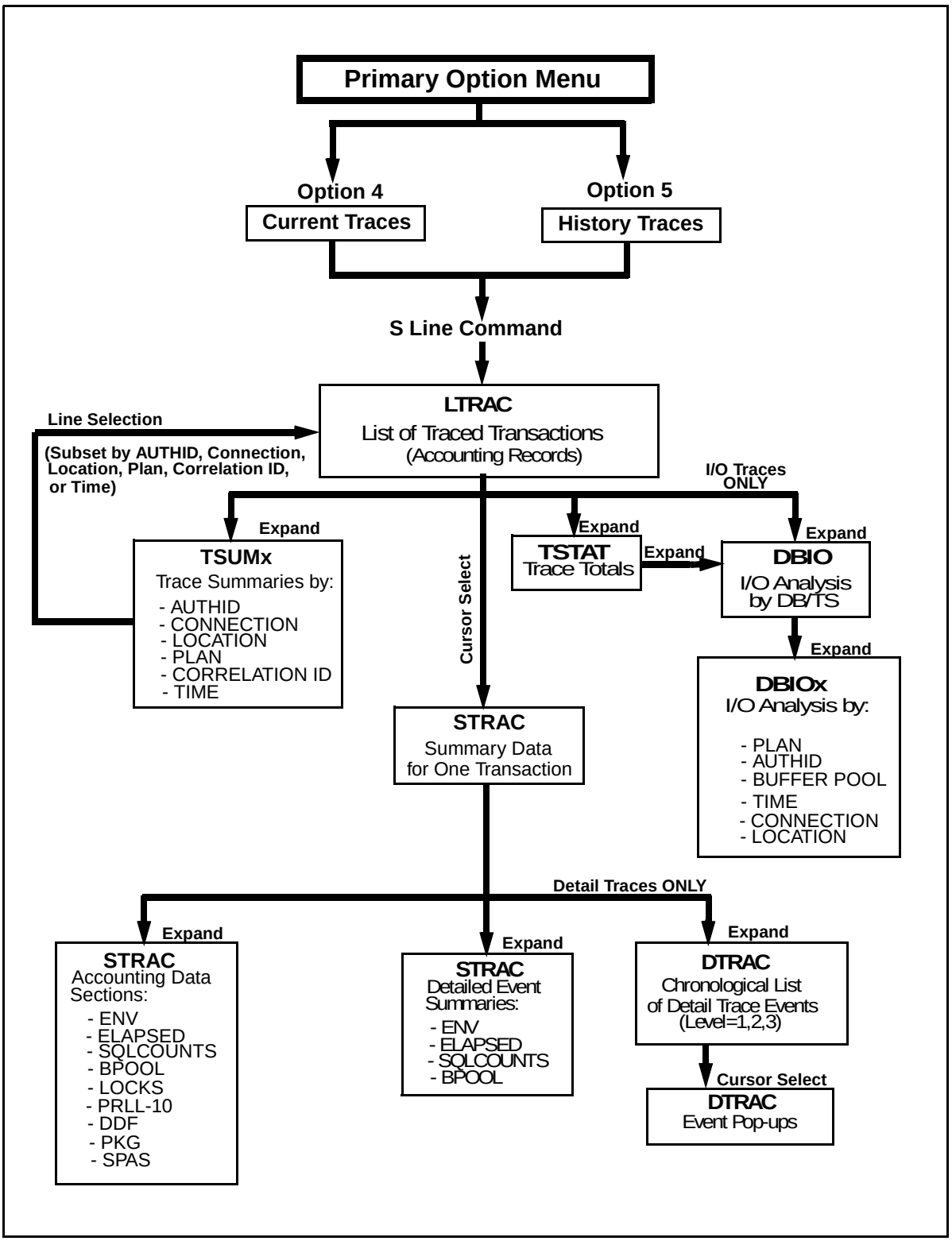


Figure 77. Trace Display Service Access

All Trace Entries (DB2 Accounting Records)

Whether selected from Option 4 or 5, all the trace displays are the same, except for a few minor differences. So we will continue here with Option 5.

To view all trace entries in a trace log data set:

1. Sort by USERID.

   ```
   COMMAND ===> SORT US
   ```

2. Locate your user ID (like ISPF LOCATE).

   ```
   COMMAND ===> L userid
   ```

3. Select the trace log data set that you just created.

   ```
   LC   (Line Command)
    S   (for Select)
   ```

   The first panel of trace data is displayed, as shown in Figure 78.

Expand from Any Entry for More Information

```
BMC Software --------------   DB2 TRACE ENTRIES     -------------  RX AVAILABLE
SERV ==> LTRAC           INPUT    14:11:09  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02                                      ROW 1 OF 24 SCROLL=> CSR
EXPAND:  MON(WKLD), TOTALS, I/O-DB/TS, HISTORY        ENTRIES IN DATASET 1 - 132
         AUTH, CONNECT, PLAN, TIME, LOC, LINESEL(STRAC)
  17SEP2002               PBCRCP - SQL/SCAN/IO
  END TIME     PLAN    AUTHID  CONNECT   ELAPSED   CPU    # STMTS GETPAGE REASON
 ---------- -------- -------- -------- -------- -------- ------- ------- ------
 09:17:52.76 DSNTIA21 CIR8X    BATCH       13 s    268 ms       4     459 OK TRM
 09:18:10.33 DSNTIA21 CIR8X    BATCH       11 s    220 ms      12     168 OK TRM
 09:18:32.78 DSNTIA21 CIR8X    BATCH    8,768 ms   218 ms      12     162 OK TRM
 09:18:55.13 DSNTIA21 CIR8X    BATCH    9,225 ms   214 ms      12     162 OK TRM
 09:19:19.80 DSNTIA21 CIR8X    BATCH       11 s    216 ms      12     162 OK TRM
 09:19:44.59 DSNTIA21 CIR8X    BATCH       11 s    216 ms      12     162 OK TRM
 09:20:09.28 DSNTIA21 CIR8X    BATCH       11 s    217 ms      12     162 OK TRM
 09:20:34.83 DSNTIA21 CIR8X    BATCH       11 s    215 ms      12     162 OK TRM
 09:21:00.54 DSNTIA21 CIR8X    BATCH       12 s    218 ms      12     162 OK TRM
 09:21:24.18 DSNTIA21 CIR8X    BATCH       10 s    215 ms      12     162 OK TRM
 09:21:47.62 DSNTIA21 CIR8X    BATCH       10 s    217 ms      12     162 OK TRM
 09:22:05.21 DSNTIB21 CIR8X    BATCH    1,117 ms   112 ms      49      59 OK TRM
 09:22:16.03 DSNUTIL  CIR8X    UTILITY  2,907 ms   163 ms       0      64 OK TRM
 09:22:17.93 DSNUTIL  CIR8X    UTILITY  1,886 ms   107 ms       0      61 OK TRM
 09:22:36.33 DSNTIA21 CIR8X    BATCH       10 s    204 ms       4     357 OK TRM
 09:22:43.14 DSNTIB21 CIR8X    BATCH    1,981 ms    73 ms      49      32 OK TRM
 09:22:59.79 DSNTIB21 CIR8X    BATCH    1,439 ms    69 ms      49      30 OK TRM
```

Figure 78. DB2 Trace Entries Display (LTRAC)

LTRAC lists all threads (trace entries) in chronological sequence, with the newest at the bottom. Each entry corresponds to a completed transaction, query, or batch job. There is one entry for each DB2 accounting record. In addition to the thread identifiers (plan, authid, connection), some of the most important performance indicators are shown.

4. Use the scroll keys **PF7** and **PF8** to scroll back and forth in the list.

   ENTRIES IN DATASET on line 4 tells you how many threads were traced. (This line says ENTRIES IN BUFFER from a current trace.) Compare the values for ELAPSED, CPU, #STMTS, and GETPAGE and look for high activity.

   Note: Use the **HISTORY** button to see all the data from the current TLDS. You *must* do this to see data for a long-running thread that has not yet terminated.

5. Tab to any entry and press **Enter** to see more detailed information.

Data for One Thread

The Summary Trace Entry display, STRAC**,** shows summary data for this thread. There are complete activity statistics from the DB2 accounting record. For a detail trace, there also are summaries of the captured detail events, such as SQL statements.

The most critical information is summarized in the base section, shown in Figure 79. It includes

- Identifiers
- Completion status
- Commits and rollbacks
- A runtime graphic analysis of elapsed and CPU times
- The most important activity counts
- Key indicators of failures or possible problems

Most Critical Information

```
BMC SOFTWARE --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC            INPUT   14:25:51  INTVL=> 3  LOG=> N  TGT==> DB2K
PARM ==> BIGELAP SEQ=209                            ROW 1 OF 119 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL
        ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, RTN, DDF

STOP.....16OCT 11.16.37.94 PLAN.............DSNTEP71 TYPE.............ALLIED
START....16OCT 11.16.27.53 AUTHID............BOLDJW1 CONNECT........BATCH/TSO
ELAPSED.............10 s  ORIG PRIM AUTH.....BOLDJW1 CORR ID.....BOLDJW4A
TERM........NORMAL/DEALLOC COMMITS.................1 ROLLBACKS.............0
------------------------------------------------------------------------------
RUNTIME ANALYSIS   IN DB2     IN APPL.      TOTAL      %IN DB2(=)     TOTAL(*)
----------------   --------   --------   --------     0 ...25...50...75..100%
ELAPSED TIME          10 s      103 ms      10 s      | ==================* |
CPU TIME             172 ms      17 ms     188 ms     | <                    |
DB2 WAIT TIME         10 s                            | ==================  |
- - - - - - ACTIVITY - - - - - -      - - - - - KEY INDICATORS  - - - - - - - -
TOTAL SQL.....................63     FILTER:  ELAPSED = 10,412 (>10,000)
GETPAGES....................4,112     SQL: SELECT=     0, FETCH=    20
SYNC READS (PRLL=00) .........887     SQL: DYNAMIC(PREPARE)=    11
PREFETCH PAGES READ...........919     I/O RSP: SYNC= 5,543 us, ASYNC=    24 ms
UPDATES/COMMIT................0.0     RID LIST PROCESSING USED =     10
BFR HIT RATIOS:...VP= 56%,HP=  0%
```

Figure 79. Summary Trace Entry Display (STRAC)—Base Section

View DB2 Accounting Data

You can scroll down or expand to sections showing complete details on SQL statements by type, lock counts, buffer activity, and parallel I/O and package accounting:

1. Select **ELAPSED** in the ACCOUNTING EXPAND line.

   If you run DB2 with Accounting Trace 2 or 3 active, an Elapsed Time Analysis section is displayed, as shown in Figure 80.

Why Are You Waiting?

```
- - - - - - - - ELAPSED TIME ANALYSIS (ACCTG CLASSES 2 3 ONLY) - - - - - - - -

CATEGORY           #EVENTS AVG/EVENT  ELAPSED  %TOTAL
----------------   ------- --------- -------- ------- 0 ...25...50...75..100%
ELAPSED TIME                                          |                      |
  IN DB2                                10 s    99.00 | ******************   |
  IN APPLICATION                       103 ms    0.99 | <                    |
 --TOTALS--                              10 s   100.00 | ******************** |
WAITS IN DB2 (LOCAL)                                  |                      |
  LOCK/LATCH             4      6 us    23 us    0.00 |                      |
  I/O WAIT             887  5,543 us 4,917 ms   47.22 | *********            |
  LOG WRITE I/O          0      0 us     0 us    0.00 |                      |
  OTHER READ I/O       218     24 ms 5,181 ms   49.76 | *********            |
  OTHER WRITE I/O        0      0 us     0 us    0.00 |                      |
  UNIT SWITCH EVENTS                                  |                      |
  ..COMMIT/ROLLBK        0      0 us     0 us    0.00 |                      |
  ..OPEN/CLOSE           0      0 us     0 us    0.00 |                      |
  ..SYSLGRNG             0      0 us     0 us    0.00 |                      |
  ..DATASPACE MGR        0      0 us     0 us    0.00 |                      |
  ..OTHER                0      0 us     0 us    0.00 |                      |
  ARCH. LOG(QIS)         0      0 us     0 us    0.00 |                      |
  ARCH.READ(TAPE)        0      0 us     0 us    0.00 |                      |
  DRAIN LOCK             0      0 us     0 us    0.00 |                      |
  CLAIM RELEASE          0      0 us     0 us    0.00 |                      |
  PAGELATCH CONT.        0      0 us     0 us    0.00 |                      |
  SPAS SERVER TCB        0      0 us     0 us    0.00 |                      |
  Force-at-commit        0      0 us     0 us    0.00 |                      |
---TOTAL WAITS---    1,109  9,106 us    10 s    96.98 | ******************   |
*NOT ACCOUNTED                          38 ms    0.36 | <                    |
```

Figure 80. STRAC Elapsed Time Analysis (ELAPSED) Section

The graph tells you at a glance where the most time is being spent—and what you should concentrate on in tuning: more time in the application or in DB2; if in DB2, are the times for I/O, prefetch reads, or lock waits unusually high?

2. Select **BPOOL** in the ACCOUNTING EXPAND line.

   This section provides a complete summary of activity for each buffer pool accessed plus totals, as shown in Figure 81.

Buffer Pool Problems?

```
- - - - - - - - - - - - - - - - BUFFER POOL ACTIVITY - - - - - - - - - - - - - - - -
ACTIVITY                TOTAL       BP0       BP1       BP2
------------------   --------  --------  --------  --------
GETPAGES...........     4,112        80     2,032     2,000
SYNC READS.........       887         0       887         0
GETPAGES/READIO....       4.6       0.0       2.3       0.0
COND. GP FAILURES..         0         0         0         0

SEQ. PREFETCH REQS.        10        10         0         0
LIST PREFETCH REQS.       200         0         0       200
DYNAMIC PREFETCHES.         0         0         0         0
ASYNC PAGES READ...       919         0         0       919
PAGES/PREFETCH REQ.       4.4       0.0       0.0       4.6

PAGE UPDATES.......        40        40         0         0
IMMEDIATE WRITES...         0         0         0         0

HP SYNC READS......         0         0         0         0
HP SYNC READ FAIL..         0         0         0         0
HP ASYNC PAGES READ         0         0         0         0
HP SYNC WRITES.....         0         0         0         0
HP WRITE FAILURES..         0         0         0         0

             - - - - GLOBAL BUFFER POOL (DATA SHARING ONLY) - - - -
CF READS (BUFFER CROSS INVALIDATION)
 -DATA RETURNED....         2         -         2
 -R/W INTEREST.....         1         -         1
 -NO R/W INTEREST..         1         -         1
CF READS (DATA NOT IN BUFFER POOL)
 -DATA RETURNED....         2         -         2
 -R/W INTEREST.....         1         -         1
 -NO R/W INTEREST..         1         -         1
CF-WRITE (CHGD PGS)         2         -         2
CF-WRITE (CLEAN PG)         1         -         1
```

Figure 81. STRAC Buffer Pool (BPOOL) Section

The GETPAGE / READ I/O ratio can give you a good indication of synchronous READ efficiency, which directly affects thread elapsed time. However, you should also check the prefetch requests, since some I/O may be occurring asynchronously.

3. Select each of the expand buttons shown in the ACCOUNTING line.

   This is all the data you would see with a low-overhead summary trace.

4. The package accounting section is available only if DB2 accounting class 7 is active, and shows a breakdown of elapsed, CPU, and wait times (class 8) per package/DBRM, as shown in Figure 82.

Select a Package for More Information

```
- - - - - - - - PACKAGE / DBRM OVERVIEW (ACCTG CLASSES 7,8 ONLY) - - - - - - -

PACKAGE/                                                %TOTAL
DBRM       NO. SQL  CPU TIME  WAIT TIM  ELAPSED   ELAP. 0 ...25...50...75..100
-------- --------  --------  --------  -------- ------ -----------------------
RXSEL1M          5     23 ms    611 ms    860 ms   9.78 | *                     |
RXSEL2M          6     21 ms    514 ms    538 ms   6.12 | *                     |
RXSEL3M         24     38 ms    193 ms    250 ms   2.84 | <                     |
RXSEL4M          8     22 ms    765 ms    828 ms   9.43 | *                     |
RXSEL5M          9     24 ms    298 ms    337 ms   3.83 | <                     |
RXSEL6M         10     25 ms    363 ms    408 ms   4.64 | <                     |
RXSEL7M         11     26 ms    179 ms    211 ms   2.40 | <                     |
RXSEL8M         12     28 ms    270 ms    299 ms   3.40 | <                     |
RXSEL9M         13     27 ms    288 ms    351 ms   3.99 | <                     |
RXSELAM         14     28 ms    256 ms    286 ms   3.25 | <                     |
```

Figure 82. STRAC Package/DBRM Overview (PKG) Section

Select one package to see further details in a pop-up display.

5. Press **PF3** to return to STRAC.

View Detail Event Summaries (Detail Trace Only)

Since you started a detail trace, there are several more sections with data summarized from detail event records. You don't have to collect and analyze each type of data separately, the MAINVIEW for DB2 trace does it all for you. You can keep scrolling to see all the data, but there is a quicker way to select just the data you want.

SQL Statement Summary

To view summary data for each SQL statement:

1. Tab through the SUMMARIES EXPAND line to the **SQL** button and press **Enter**.

   The SQL Summary is displayed, as shown in Figure 83, with important statistics for each SQL statement, showing totals and averages across all executions. If the plan contains multiple DBRMs, the statements are sorted by package/DBRM (program).

Check Each SQL Statement

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,SQL,SORT=PGM                   ROW 1 OF 18 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

- - - - - - - - - - - - SQL SUMMARY (DETAIL TRACE ONLY) - - - - - - - - - - - -

  STMT                  AVG.     %      AVG.     %    SORT  -- PAGES SCANNED --
  TYPE   STMT  COUNT   ELAPSED  ELAP    CPU     CPU   RECS  INDX DATA WORK  REF
------- -----  -----  -------- -----  -------- -----  ----  ---- ---- ---- ----
SELECT   3228      1     25 ms   2.7  1,930 us   0.3     0     2    1    0    0
SELECT   3347      2     11 ms   2.4  4,047 us   1.5     0    11    4    0    0
OPEN     3565      6    172 us   0.1    170 us   0.2     0     0    0    0    0
FETCH    3578     11  1,986 us   2.3    782 us   1.6     0    19    3    0    0
CLOSE    3664      6    192 us   0.1    149 us   0.2     0     0    0    0    0
SELECT   3671      6  1,776 us   1.1  1,091 us   1.2     0    12    0    0    0
SELECT   3283      1  2,643 us   0.3  1,888 us   0.3     0     1    0    0    0
OPEN     3299      1    109 us   0.0    107 us   0.0     0     0    0    0    0
FETCH    3313      2    907 us   0.2    855 us   0.3     0     1    0    0    0
CLOSE    3334      1    142 us   0.0    141 us   0.0     0     0    0    0    0
OPEN     3456      1    693 ms  74.1    414 ms  74.9     8    23 1187    2    0
FETCH    3468      5    440 us   0.2    322 us   0.3     0     0    0    6    0
SELECT   4803      1  1,269 us   0.1  1,121 us   0.2     0     2    0    0    0
PGM: P025D100     44            83.9            81.0     8    71 1195    8    0

SELECT   1239      1  1,040 us   0.1  1,040 us   0.2     0     2    1    0    0
OPEN     1263      1     66 ms   7.1     47 ms   8.6   172    13    6    9    0
FETCH    1273     87    201 us   1.9    177 us   2.8     0     0    0    2    0
CLOSE    1324      1    250 us   0.0    250 us   0.0     0     0    0    0    0
OPEN     1333      1     15 ms   1.6     14 ms   2.6     7     6    4    5    0
FETCH    1343      5    254 us   0.1    254 us   0.2     0     0    0    2    0
SELECT   1375      3  1,746 us   0.6  1,165 us   0.6     0     0   12    0    0
CLOSE    1393      1    126 us   0.0    126 us   0.0     0     0    0    0    0
PGM: P025D200    100            11.4            15.0   179    21   23   18    0

SELECT    389      1     38 ms   4.2     18 ms   3.4     0    10    3    0    0
OPEN      482      1    135 us   0.0    134 us   0.0     0     0    0    0    0
FETCH     489     10    459 us   0.5    302 us   0.5     0     1    0    0    0
PGM: P025D300     12             4.7             3.9     0    11    3    0    0

** TOTALS ***    156                                    187   103 1221   26    0
```

Figure 83. STRAC SQL Summary Section

2. Scan the PERCENT ELAPSED column.

   The percent tells you how much this statement is contributing to the total thread elapsed time. An average may be high, but if only executed a few times, the statement may not be worthwhile tuning.

3. Scan the SORT RECS column to see which statements invoked a sort.

   Although EXPLAIN tells you a sort will be used, it can't tell you whether many rows will be selected and sorted, or just a few. This column does. (Of course, as always, you must adjust this by any differences between your test and production tables.)

4. Scan the PAGES SCANNED - INDX column.

   This tells you whether an index was accessed and how many pages were scanned. If this value doesn't meet your expectations, there is more information on index accesses a little further along.

5. Check for referential integrity processing. See the PAGES SCANNED - REF column.

6. Sort the display by PAGES SCANNED - DATA.

   ```
   PARM ==> traceid,SEQ=nn,SQL,SORT=PD
   ```

7. Now sort the display by PAGES SCANNED - DATA within Program.

   ```
   PARM ==> traceid,SEQ=nn,SQL,SORT=PDP
   ```

   The first characters of the column header are used to request a sort. Adding P as the third character keeps all the statements for each DBRM together. All options are defined in the HELP panels (PF1). (The sort is supported only when you expand to the section, not when you scroll to it.)

8. Place the cursor on one of the SQL statement lines and press Enter.

   This pop-up display, shown in Figure 84, shows the complete statistics for that statement, displayed as averages per execution. Where the single line shows total counts of pages scanned, the pop-up display shows averages not only for pages but also rows accessed.

Evaluate SQL Predicates

```
 BMC Software --------------  DETAIL TRACE ENTRY ------------------ RX AVAILABLE
 SERV ==> STRAC           INPUT    10:22:51  INTVL=> 3  LOG=> N  TGT==> DB2G
 PARM ==> TEST3,SEQ=000017,SQL                ROW     1 OF    18 SCROLL=> CSR
 EXPAND:  SQLTEXT(EXPLAIN)

STATEMENT:  350  SELECT                              NUMBER OF EXECUTIONS:      2
PLAN:       DSNESPRR                 ELAPSED:  AVERAGE 2,794 us   TOTAL 5,588 us
PROGRAM:    DSNTIAUL                 CPU:      AVERAGE 1,271 us   TOTAL 2,543 us
LOCATION: DB1D
PACKAGE:  SAJUYH2I                              ----------------------------
                                                   INDEX  SEQ-DATA  SEQ-WORK
                                                --------  --------  --------
ROWS PROCESSED ALL TYPES                               4         2         0
ROWS PROCESSED CORRECT TYPE                            4         2         0
ROWS QUALIFIED BY DM (STAGE 1)                         3         0         0
ROWS QUALIFIED BY RDS (STAGE 2)                        0         0         0
ROWS INSERTED                                          0         0         0
ROWS UPDATED                                           0         0         0
ROWS DELETED                                           0         0         0
PAGES SCANNED                                          8         2         0
REFERENTIAL INTEGRITY PROCESSING:
 PAGES SCANNED                                         0         0         0
 ROWS DELETED/SET NULL                                 0         0         0
LOB- PAGES SCANNED                                     0         0         0
   - PAGES UPDATED                                     0         0         0
```

Figure 84. STRAC SQL Statement Pop-Up Display

These are the statistics that allow you to evaluate the SQL predicates. For example, ROWS QUALIFIED BY RDS are caused by Stage 2 predicates and are more expensive than rows qualified in the first stage by the Data Manager (ROWS QUALIFIED BY DM). Of course, there may be variations per execution depending on host variable values. You will see how to find the statistics per single statement execution later.

9. If RxD2 is installed and this is a static SQL statement, the **SQLTEXT(EXPLAIN)** expand button is highlighted. You can select this to view the SQL text from the catalog and access available EXPLAIN data from a PLAN_TABLE or do a dynamic EXPLAIN. This feature is shown later in "Using RxD2 with MAINVIEW for DB2" on page 123.

   If the MAINVIEW for DB2 – Data Collector component is available, you can access more thorough EXPLAIN information by hyperlinking on the **MVDB2/DC Admin/Archive** option on the EZDB2 Menu and then selecting option **E** (**EXPLAIN Interface**). You can view static SQL EXPLAIN data from the plan or package SQL data, or from PLAN_TABLE data that has been previously populated.

10. Press **PF3** to return to STRAC.

Table Space / Index Space Scans

To view table space and index space scans:

1. Tab through the EXPAND line to the **SCANS** button and press **Enter.**

   Here you can see a summary of all scans by table space and index space, as shown in Figure 85.

Review Table Spaces and Index Access

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:46  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,SCAN,SORT=DA                   ROW 1 OF 11 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

 - - - - - - - - - - - DATABASE SUMMARY (DETAIL TRACE ONLY) - - - - - - - - - -

                         ------ INDX -----  ------ DATA -----  ------ WORK -----
DATABASE  PAGESET OBID  #SCAN #PAGE #ROWS  #SCAN #PAGE #ROWS  #SCAN #PAGE #ROWS
--------- -------- ----- ----- ----- -----  ----- ----- -----  ----- ----- -----
DD028     S021FT10     8    16    32   193     12     9   185      0     0     0
DD028     S021FT20    13    94    18   110      2     4    16      0     0     0
DD028     S021FT30    18     0     0     0      3    12    39      0     0     0
DD028     S021FT40    23     3     3   360      0     0     0      0     0     0
DD028     S021PR10    28     6    12     7      6  1181 44566      0     0     0
DD028     S021PR30    33    33    36   815     11    14   298      0     0     0
DD028     S021UI10    40     1     2     1      1     1     1      0     0     0
DSNDB07   DSN4K01      3     0     0     0      0     0     0      3     6     0
DSNDB07   DSN4K02      5     0     0     0      0     0     0      1     2     0
DSNDB07   DSN4K03      7     0     0     0      0     0     0      2     4     0
**** TOTALS *****        153   103  1486     35  1221 45105      6    12     0
```

Figure 85. STRAC Database Summary Section

This data is available only if you requested SCANS on the trace request. It allows you to review the number of rows and pages accessed per page set, and also see which indexes were used.

Lock and I/O Events

To analyze lock and I/O problems:

1. Tab through the EXPAND line to the **IO/LOCK** button and press **Enter**.

   This display, shown in Figure 86, is a summary of all lock and I/O activity by this application, shown by table space and index space. The lock data is available with any detail trace. The I/O data is available only if you requested I/O events on the trace request, which can be expensive, depending on the application characteristics.

Analyze Lock and I/O Problems

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:53  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,IOLOCK,SORT=DP                 ROW 1 OF 11 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

 - - - - - - - - - DATABASE LOCK AND I/O SUMMARY (DETAIL TRACE ONLY) - - - - - -

                   ------ LOCKS -----  --------- SYNC. I/O ---------  ASYNC I/O
 DATABASE  PAGESET  MAX. SUSP. TM/OUT   READ WRITE  ELAPSED AVG.ELAP  READ PAGES
 -------- -------- ----- ----- ------  ----- ----- -------- -------- ----- -----
 B1C0DB   BB040A12     0     0      0      1     0    21 ms    21 ms     0     0
 B2C0DB   BB051012     2     0      0      1     0    18 ms    18 ms     0     0
 B3C0DB   BB09TS02     3     0      0      0     0     0 us     0 us     0     0
 **** TOTALS *****     5     0      0      2     0    39 ms    19 ms     0     0
```

Figure 86. STRAC Database Lock and I/O Summary Section

For traces by AUTHID, where SYSOPR is included, you will also see counts for prefetch read requests and the number of pages read for this thread. The other counts are all for synchronous I/O within the application. In other words, the ELAPSED time shown here is part of the total thread elapsed time. Reducing the total number of synchronous I/Os has a direct effect on performance.

We will show you later how to relate these I/Os to the packages/DBRMs and even the SQL statements that caused them. (See “Application I/O Analysis” on page 92.)

Avoiding Expensive Lock Event Traces

A lock trace is usually only requested to analyze a specific locking problem, since it causes a great deal of DB2 overhead and also generates many trace records for MAINVIEW for DB2 to store online and/or log. Therefore, before you decide to trace LOCK events, you should analyze the following detail trace events available in DTRAC (shown next):

LOCK-SUMMARY (display LEVEL=2)
: This event appears near the end of the thread processing. It shows the maximum number of page locks held and the highest lock state for each page set (table/index space) accessed.

LOCK-TMO (display LEVEL=1)
: This event is shown for any thread terminated by either a timeout or deadlock. It shows the page set involved and identifies the first holder of the lock that was in contention, as well as the state of the lock (for example, held exclusive). It is followed by either a DEADLOCK or LOCK-TMO-DET event (display LEVEL=2) that gives complete details.

LOCK-SUSP (display LEVEL=3)
: This event is shown for all lock suspensions. It shows the elapsed time suspended, the page set, the type of entity locked (for example, a data page, index tree, and so on), page number if applicable, and lock state.

Sort Information

To evaluate the impact of sorting:

1. Tab through the EXPAND line to the **SORTS** button and press **Enter**.

   A Sort Summary of all the sort activity for this plan execution is displayed, as shown in Figure 87.

Evaluate Impact of Sorting

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,SORTS                          ROW 1 OF 18 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

- - - - - - - - - - -  SORT SUMMARY (DETAIL TRACE ONLY) - - - - - - - - - - -

                                        SORT      SORT      RECORD
                                     ELAPSED    RECORDS     SIZE
                                    --------   --------   -------
NUMBER OF SORTS........6    AVERAGE     135 ms         31      353M
AVG # WORK FILES.....1.3    MAXIMUM     263 ms         86    2,118M
                            MINIMUM     263 ms          3         0
                            TOTAL       263 ms        187       N/A
                         ********** END OF DATA **********
```

Figure 87. STRAC Sort Summary Section

When scrolling through STRAC, this section is at the end of the display. The SORT ELAPSED time allows you to evaluate the impact of sorting on the total thread elapsed time. Since there may be multiple sorts, the values are shown as averages, maximums, minimums, and totals.

Now you have seen all the summarized data for one thread by browsing through an STRAC (Summary Trace Entry) display. Even with a low-overhead summary trace, the complete accounting data, elapsed time analysis, buffer pool usage analysis, and DDF information is available. The other summarized data depends on the type of events you decide to trace: SQL, SCANS, IO, LOCKS.

2. Press **PF3** several times until you return to the initial STRAC display.

Another Thread

If you have traced several thread executions, you may now want to view another thread. Look at the PARM field. The SEQ=nnnnnn field shows you the sequence number of this trace entry (accounting record plus summarized details) and allows you to navigate between entries.

To view another thread:

1. Press **PF10** to scroll to the next chronological entry.
2. Press **PF11** to scroll back to the previous entry.
3. Select the **SQLCOUNTS** expand button to view the summary of all SQL statements; then press **PF10** several times.

   The display shows the SQL counts for the following threads. This is an easy way to compare particular statistics (such as SQL, elapsed times, or GETPAGEs) for several threads.

Detail Events

There is another level of trace data available for a detail trace. It shows all the traced events for a thread in chronological sequence. To see the detail event statistics:

1. Tab through the EXPAND line to the **DETAIL** button and press **Enter.**

   The DTRAC (Detail Trace Entry) display allows you to follow the sequence of events during thread processing, as shown in Figure 88.

Follow the Sequence of Events

```
BMC Software --------------  DETAIL TRACE ENTRY --------------PERFORMANCE MGMT
SERV ==> DTRAC           INPUT    10:21:48  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TEST3,SEQ=000017,LEVEL=2              ROW     1 OF    35 SCROLL=> CSR
EXPAND:  LINESEL(DETAIL), HISTORY
START: 09:17:11 AUTH: JEK1     PLAN: DSNTIB21 CORR: DB221REQ     CONN: BATCH
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
------------- -------- -------- -------- ----------------------------------
CREATE-THD        0.000    45 ms 4,492 us
 PLAN-ALLOC       0.045                    ISOLATION=CS ACQ=USE   REL=COMMIT
PKG-ALLOC         0.065                   *DSNESPCS ISO=CS ACQ=USE   REL=COMIT
PREPARE   350     0.069 1,361 ms    26 ms *RC(   0) C=DT         D/X   PS(  10)
 BIND-TEXT        0.070                   *TYPE=DYNAMIC  TEXT=SELECT * FROM DS+
 EXPLAIN          0.078                   *PLAN=DSN8IC22 COST(4.6)
 EDM-REQ          1.302   123 ms 3,964 us  DB=00000258
OPEN      524     1.489   204 us   202 us *RC(   0) C=DT
FETCH     532     1.489 2,058 ms 6,247 us *RC(   0) C=DT         D/X   PS(   2)
 OPEN-TS          2.235                    DB=DSN8D21A TS=DSN8S21D
 OPEN-TS          3.352                    DB=DSN8D21A TS=XDEPT3
FETCH     532     3.549    35 ms   441 us *RC(   0) C=DT         D/X
FETCH     532     3.615   354 us   353 us *RC(   0) C=DT         D/X
FETCH     532     3.616   335 us   335 us *RC(   0) C=DT         D/X
FETCH     532     3.620   354 us   353 us *RC(   0) C=DT         D/X
FETCH     532     3.621   386 us   387 us *RC(   0) C=DT         D/X
FETCH     532     3.672   386 us   387 us *RC(   0) C=DT         D/X
FETCH     532     3.673   337 us   337 us *RC(   0) C=DT         D/X
```

Figure 88. Detail Trace Display for a Thread (Level 2)—DB2 Requests

   The number and type of events shown depend on how much you decided to trace (more events, more overhead). The simplest detail trace captures just the major events and exceptions in the life of the thread. This trace also has SQL, SCANS, and IO.

2. Look at the first event, CREATE-THD.

   Events like this, with start and end trace records, are matched and displayed on one line with relative start time, elapsed, and CPU times. Events that occur within another event (like I/O for a scan) are indented.

3. Look at the PARM field.

   The SEQ number is the same as that shown on the Summary display (STRAC). But now there is a new parameter of **LEVEL=2**. This parameter allows you to widen or narrow your view of all the traced events. Level 2 shows you the major events (for example, the first event you see is probably PLAN-ALLOCation) and SQL.

4. Change the level to 1 to see just the SQL statements.

   ```
   PARM ==> traceid,SEQ=nnnnnn,LEVEL=1
   ```

   Browse through the SQL statements to find one you want to know more about.

5. Tab to that statement and press **PF7** to scroll it to the top (SCROLL => CSR).

6. Change the level to 3 to see SCANS and I/O.

   ```
   PARM ==> traceid,SEQ=nnnnnn,LEVEL=3
   ```

   The events always remain in chronological sequence, and the event at the top of the screen remains there. Now you can see all of the events that occurred in processing the SQL statement—index scans, data scans, table space opens, sorts, dynamic SQL text and EXPLAIN data, I/O, and so on.

7. Move the cursor to an SQL statement and press **Enter**.

   Here are the statistics for the single SQL statement, shown in Figure 89, available in a pop-up display whenever you need them, but out of the way when browsing the events.

Event Pop-Up

Access More Information

```
BMC Software --------------   DETAIL TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> DTRAC           INPUT    10:48:24  INTVL=> 5  LOG=> N  TGT==> DB2HSR
PARM ==> ALLNEW51,SEQ=4,LEVEL=2                      ROW 1 OF 17 SCROLL=> CSR
EXPAND: .SQLTEXT(EXPLAIN)
START: 13:59:23 AUTH: BOLSMR3  PLAN: DSNTIA51 CORR: DB251REQ     CONN: BATCH
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
-------------- -------- -------- -------- -----------------------------------
CREATE   1817     0.475    14 s     62 ms *RC(   0) TABLESPACE DEMOS51D
================================================================================
CURSOR:    DEMOS51D
LOCATION:  DB2H
ISOLATION: READ STABILITY
REOPTIMIZ: REOPTIMIZATION FOR INPUT VARS
PACKAGE:   SAJUYH2I
PROGRAM:   DSNTIAD                              INDEX  SEQ-DATA
                                               --------  --------
        ROWS PROCESSED ALL TYPES                      6         6
        ROWS PROCESSED CORRECT TYPE                  12         6
        ROWS QUALIFIED BY DM (STAGE 1)                6         0
        ROWS QUALIFIED BY RDS (STAGE 2)               0         0
        ROWS INSERTED                                 0         1
        ROWS UPDATED                                  0         0
        ROWS DELETED                                  0         1
        PAGES SCANNED                                17        14
       REFERENTIAL INTEGRITY PROCESSING:
        PAGES SCANNED                                 0         0
        ROWS DELETED/SET NULL                         0         0
       LOB- PAGES SCANNED                             0         0
          - PAGES UPDATED                             0         0
```

Figure 89. DTRAC SQL Statement Pop-Up Display

Any event that has an asterisk at the beginning of the DETAIL column has a pop-up display. The detail column shows the most important data, but many trace records have much more information available. This data varies by event type. For example, for an SQL statement, you see the return code, cursor, indicators about data access (Data/Index/Work = D/X/W), and pages scanned.

You have already seen the SQL pop-up display; the same row/page statistics are available per scan. Some other important pop-up displays are

BIND-TEXT	Text of dynamic SQL (also static SQL if BIND traced)
EXPLAIN	EXPLAIN data for dynamic SQL (also from BIND)
LOCK-SUMMARY	Summary of locks held per page set
LOCK-TMO	Identification of lock holder causing a timeout/deadlock
RIDLIST	Statistics on RID list processing, success, or failure

8. Press **PF3** three times to return from DTRAC to the LTRAC list of thread entries.

Summarized Data for All Threads

Now look at data that has been summarized for all the threads that have been traced:

1. In LTRAC, tab to the **TOTALS** expand button and press **Enter** to access the TSTAT display, as shown in Figure 90.

Trace Totals

```
BMC SOFTWARE --------------    TRACE STATISTICS     -------------  RX AVAILABLE
SERV ==> TSTAT            INPUT   14:38:24  INTVL=> 3  LOG=> N  TGT==> DB2K
PARM ==> BIGELAP                                   ROW 1 OF 153 SCROLL=> CSR
EXPAND:  MON(WKLD)  HISTORY
        ACCOUNTING: ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, RTN, DDF

- - - - - - - - - - SUMMARY STATISTICS - ALL TRACE ENTRIES- - - - - - - - - -
-----TERMINATIONS ----------    ---------ACTIVITY-----------------------------
FIRST END..16OCT 09.34.27.28               TOTAL   AVERAGE   MAXIMUM   MINIMUM
LAST END...16OCT 13.57.44.24            --------  --------  --------  --------
NUMBER THREADS...........211    ELAPSED  12:08:02  00:03:27  07:20:52     10 s
COMMIT/ROLLBK.....210/.....1    ELP-DB2  00:50:24     14 s   00:01:45    851 ms
NORMAL TERM..............208    CPU         55 s     260 ms  9,606 ms     24 ms
-- NEW USER..............0    CPU-DB2     40 s     188 ms    758 ms     15 ms
-- DEALLOC...............207    WAITS    00:47:29     14 s      36 s     240 ms
-- APPL END..............1    SQL        13,050        61        63         4
-- RESIGNON..............0    GETPAGES  852,770     4,041     2,088        27
-- DBAT INACT............0    SYNC RDS  184,661       875     1 019         0
-- IFI READ..............0    PFCH PGS  188,995       895     1 257         0
ABNORMAL TERM............1    UPD/COMT        0         0         0         0
IN DOUBT TERM............2    BFR HIT RATIOS:.....VP= 56%,HP=  0%
- - - - - - KEY INDICATORS - - - - - - - - - - - - - - - - - - - - - - - - - -
SQL: SELECT=     0, FETCH= 4,143
SQL: DYNAMIC(PREPARE)= 2,279
I/O RSP: SYNC= 7,110 us, ASYNC=    37 ms
LOCK SUSPENSIONS =    158
RID LIST PROCESSING USED =  2,070
```

Figure 90. Summary Statistics for All Trace Buffer Entries (TSTAT)—Base Section

The TSTAT (Trace Statistics) display provides a summary of all traced threads. Much of the data is similar to that shown for one thread in the STRAC display, so just browse through it using the **PF8** key or select the desired accounting data sections from the EXPAND line.

TSTAT can be useful in application tuning when you trace just one plan. It gives you an overview of the performance of the plan to see if you even need to go into further detail analysis of single thread executions. If the average values meet expectations and the maximum and minimum don't vary greatly, you may be able to stop here. Also, TSTAT summarizes the key indicator values to show whether any exceptional conditions, such as RID pool failures, have occurred. After all, the art of performance analysis and tuning is to spend your time where you get the biggest payback.

2. Press **PF3** to return to LTRAC.

Application I/O Analysis

Earlier you looked at the I/O for one thread. Now look at the I/O performed for all the threads traced.

The best way to analyze the I/O workload is to use the series of DBIOx displays, available with an expand button from either LTRAC or TSTAT on an I/O trace, as follows:

1. Tab to the **I/O-DB/TS** expand button and press **Enter** to access the DBIO display, as shown in Figure 91.

Summarized I/O Events by Page Set

```
BMC Software --------------    I/O Analysis-HT      -----------PERFORMANCE MGMT
SERV ==> DBIO            INPUT    11:02:14  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SORT=DB,TOTAL                         LINE    1 OF   19 SCROLL=> CSR
EXPAND:  PLAN, AUTH, BPOOL, TIME, CONNECT, LOCATION
EXPAND:  LINESEL(DBTS), CATALOG
OPTION:  TOTAL, SYNC, ASYNC

17SEP2002                  CIR2.DB2G.JQSIO.SEP19.T1818.V01
DATA     TABLE              I/O   I/O   MAX    AVG
BASE     SPACE             COUNT    %  IOWAIT IOWAIT
-------- --------      -------- ----- --ms-- --ms-- 0 ...20...40...60...80
DSNDB01  DBD01                4   5.6     89     34 | ********              |
DSNDB01  DSNSCT02             1   1.4     28     28 | *******               |
DSNDB01  DSNSPT01             1   1.4     17     17 | ****                  |
DSNDB01  SCT02                2   2.8     38     31 | *******               |
DSNDB01  SPT01                4   5.6    351     95 | ******************** |
```

Figure 91. I/O Analysis by Database / Table Space Display (DBIO)

The first display (DBIO) summarizes the I/O events by database and table space. You can see the number and percent of I/O per table space and index space, as well as average and maximum I/O wait times. From here, you can use the expand buttons, line selection, and sort parameters to focus on the area of most interest, whether a particular table space, an application, or a specific time period.

2. Tab to **SYNC** on the OPTION line and press **Enter**.

   Now only synchronous I/O are displayed. SYNC is now in the PARM field. TOTAL (the default) includes both synchronous and asynchronous I/O. ASYNC shows the prefetch I/O.

3. Tab to **PLAN** and press **Enter**.

   Now the I/Os are summarized by plan.

4. Tab to the **I/O %** column and press **Enter** to sort the plans with the highest amount of I/O at the top of the list.

5. Line select one of the plans and press **Enter**.

   The original display by page set is shown again, but is now qualified to show only the I/Os for the selected plan.

   Press **PF3** to return to the DBIOP display.

6. Tab to **PKG/PGM** and press **Enter**.

   The programs (DBRMs or packages) per plan causing the I/O are now identified.

7. Tab to **SQL** and press **Enter**.

   This lowest level now identifies each SQL statement causing I/O, as shown in Figure 92.

SQL Statements Causing I/O

```
BMC Software -------------- I/O Analysis-SQL Stmt   -----------PERFORMANCE MGMT
SERV ==> DBIOS           INPUT    12:01:32  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SO=PL,SYNC                          LINE    1 OF    3 SCROLL=> CSR
EXPAND:  LINESEL(DBIO), CATALOG, HISTORY
OPTION:  TOTAL, SYNC, ASYNC

19SEP02                    DB2 APPLICATION TRACE
         PACKAGE/ SQL      I/O   I/O   MAX    AVG
PLAN     PROGRAM  STMT    COUNT    %  IOWAIT IOWAIT
-------- -------- ---- -------- ----- --ms-- --ms-- 0 ...20...40...60...80
RXDB2    RXSEL2M   228       30  93.8  21464   1505 | ******************** |
RXDB2    RXSEL4M   115        1   3.1     49     49 | ************         |
RXDB2    RXSEL9M   228        1   3.1     49     49 | ************         |
```

Figure 92. I/O Analysis by SQL Statement (DBIOS)

8. At any time you can return to LTRAC (press **PF3** four times from DBIOS). Select a single thread (for example, one with a high elapsed time) and look at the I/O per page set for that one execution summarized in the STRAC IO/LOCK section.

9. Select the STRAC **DETAIL** button to view the detail events. Change the display level to **3** to see I/O events.

   You can now see each I/O in the chronological sequence in which it was executed, following the SQL statement that caused it, with elapsed and CPU times.

Viewing Detail Trace Data for Active Threads

When you are running a detail trace, the events that you have just looked at in the DTRAC displays are available from the Detail User Status (DUSER) display for an active thread that is being traced.

1. Acces the DUSER display by following the steps on page 12.

2. Use the **Tab** key to move to the **UTRAC** button on the EXPAND line and press **Enter** to view this data from the buffers.

As the threads complete processing, the data becomes available from the Current Traces and History Traces options as described previously in this chapter.

Print a Trace Report

You have now run a trace and viewed it online. However, depending on the results, you may want to have a hardcopy for further analysis. Batch reports can also be valuable tools during an application review meeting.

Note: This section describes printing a trace, but you may also want to look at the accounting reports produced from SMF data, either from DB2 tables or directly from the extracted DB2 accounting records. See the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

To begin this exercise:

1. Press **PF3** several times until you return to the History Traces panel (Option 5).

   This panel not only provides access to view the trace data online but also offers several line commands to simplify management of the trace log data sets:

   W Show the options used for this trace
   P Generate the JCL to print a batch report
   D Delete this data set from the trace directory
   E Reset the log data set for reuse
   V Verify that the directory entry matches the data set contents
   N Add a new data set to the directory (moved from another system)
   A Archive the data set (only if an archive started task was specified)
   F Free a data set currently being read

Usually you will need only W(SHOW), D(DELETE), and P(PRINT). We are going to concentrate now on P. You can try the others when you need those functions.

All Data per Traced Thread

To print a trace report showing all data per traced thread:

1. Select your trace log data set for print.

   ```
   LC       (Line Command)
    P       (for PRINT)
   ```

   The Batch Trace Print panel is displayed, as shown in Figure 93, where you can specify options to print a batch report.

Printing a Trace

```
BMC Software ------------ BATCH TRACE PRINT ----------------  PERFORMANCE MGMT
COMMAND ===>                                                    TIME --- 15:00

Update job ==> N (Y/N - update job statement)                (END to edit JCL)
Title line 1 ==>
Title line 2 ==>

Data Selection:
 From date  ==> 16SEP2003  Time  ==> 1125
 To   date  ==> 17SEP2003  Time  ==> 1412

   PLAN     ==>
   AUTHID   ==>
   CONNECT  ==>
   CORR     ==>
   LOC      ==>
   DB2PKG   ==>

REPORT SELECTION:
   LTRAC ==> NO                          (YES/NO)
   STRAC ==> NO                          (NO,ALL,SUMMARY,section1,section2..)
   DTRAC ==> NO                          (YES/NO)
   POPUP ==> NO                          (NO/ALL/SQL/event1,event2,....)
   TSUM  ==>          (A/C/L/P/T)        SORT     ==>       (for any TSUMx)
   TSTAT ==> NO       (SUMMARY/ALL/NO)   INTERVAL ==> 1H    (for TSUMT only)
   DBIO  ==>          (X/A/C/F/L/P/T/xx) IOSORT   ==>       (for any DBIOx)
                                         IOINTVL  ==> 10M   (for DBIOT only)
```

Figure 93. Batch Trace Print Panel

2. If this is your first time using this option, you must update your job statements.

   ```
   Update Job ==> Y
   ```

3. Press **Enter** to display a job statement data entry panel.

   Fill in the required information and return using **PF3**.

4. Set the option to **N**.

5. Fill in the options for a report.

```
TITLE1 ==> any title   Optional. Centered in first report header.
TITLE2 ==> any title   Optional. Centered in second report header.
```

   Data Selection is optional. The selection fields can be used to reduce the amount printed from a long trace. The date and time fields are primed with the start and end date-time of the trace.

```
REPORT SELECTION:
 LTRAC   ==>  N
 STRAC   ==>  ALL             Print data per thread traced.
 DTRAC   ==>  N
 POPUP   ==>  N
 TSUM    ==>
 TSTAT   ==>  N
 DBIO    ==>
```

   There are many different reports that can be generated, either singly or in combination. Browse “Printing a Trace” in Volume 3 of the *MAINVIEW for DB2 User Guide* for a full explanation of the options and to see sample reports. There is also a sample JCL member DZTBPRNT you can use when you want to generate multiple reports or print reports from SMF data. The control statements for several sample reports are provided in BBSAMP member DZJPnnnn, with comments to point out some of the most useful variations.

   The reports are based on printouts of the online displays, so the options are selected using the names of these displays, like LTRAC, STRAC, DTRAC. In this tutorial we have chosen **STRAC=ALL** as the most useful report for application tuning. It shows the following for each thread traced:

   - Basic **DB2 accounting record** data
   - **Environmental Indicators** section
   - **Elapsed Time Analysis** section
   - **SQL Statement Execution Counts** section
   - **Buffer Pool Usage Analysis** section, including Global Buffer Pools
   - **Lock Activity** section, including Global Locks
   - **I/O Parallelism** section
   - **Routines** section (stored procedures and user-defined functions)
   - **DDF Summary** section (if distributed work was done)
   - **Package/DBRM Overview** section (if accounting trace 7 is active)

   These sections are included for detail traces:

   - **SQL Summary** section with summary statistics per SQL statement
   - **Database Summary** section with scans per page set
   - **Database Lock and I/O** section with locks and/or I/O data per page set
   - **Sort Summary** section (if any sorts were performed)

6. Press **Enter** to validate your specifications.

   These options are saved in your profile and used to initialize the fields the next time this panel is requested.

7. Press **PF3** to review the generated JCL in edit mode.

   The options you specified are inserted into a pattern job DZJPTRAC in BBPROF. You may want to copy this JCL into your own UBBPROF profile data set and modify it.

8. Check the rest of the options.

   There are many more print options than can be shown on the panel. The sample job contains a short description of these options. Scroll to the bottom to review them.

9. Submit the job.

   ```
   COMMAND ===> SUB
   ```

   Of course, if you prefer, you can **SAVE** the JCL for later execution, or even **CANCEL** it completely.

10. Press **PF3** to return to the Batch Trace Print panel. You can issue another request now if desired.

Other Examples

When the job is completed, review the output. You may want to try other report combinations too. Here are a few examples:

- For an SQL statement summary per thread, sorted by Average CPU usage, followed by average SQL row processing statistics per statement:

  ```
  LTRAC  ==>  Y
  STRAC  ==>  SQL,SORTSQL=AC,SQLPOPUP
  ```

- For a detail event trace per thread, with pop-up displays per SQL statement:

  ```
  LTRAC  ==>  Y
  DTRAC  ==>  Y
  POPUP  ==>  SQL
  ```

- For SQL statement text and EXPLAIN data for all dynamic SQL executed or BINDs of static SQL:

  ```
  POPUP ==> (BIND-TEXT,EXPLAIN)
  ```

- For a summary of I/O counts and wait times per database, table space, and plan (from an I/O trace):

  ```
  DBIO ==> XP
  ```

- To summarize by plan, database, and table space:

  ```
  DBIO ==> PX
  ```

There are also many formatting options you can adjust:

NEWPAGE Control page breaks

WIDTH Specify wide (133) or narrow (81) output

LINECNT Adjust the number of lines printed per page

HEADING Suppress headings

MAXPAGES Limit the amount of output to prevent an unexpectedly high print volume

Chapter 5. Analyzing the DB2 Workload

These scenarios teach you how to gain a quick overview of summary thread history data to identify problem areas and drill down to further detail if needed to pinpoint exception threads. You will also learn to use the trace displays and the sorting and selection features to pinpoint problem areas and exception threads.

In this practice session, you

1. Analyze recent workload history through the Thread Interval Summary views.
2. Perform detailed analysis of the thread data in an MVDB2 TLDS.
3. Perform detailed analysis of the thread data in the MVDB2/DC trace data sets.
4. Analyze DB2 I/O per table space.
5. Print workload reports for offline review.

Note: This practice session takes approximately one hour to complete.

Analyze Recent Workload History

Sometimes you might need to go back in time to analyze recent history of your DB2 workload; for example:

- To make a quick check of DB2 performance from an application perspective
- To identify system and application exceptions and relate the problems to the threads that caused them
- To analyze the performance of a specific application
- To develop an understanding of the workload profile and spot deviations

Thread History Collection

MAINVIEW for DB2 sets up a summary trace named THRDHIST of the complete DB2 workload that is started automatically and runs continuously. This trace captures the DB2 accounting records and is inexpensive to run. Usually the system administrator choses to log the data to a group of wraparound trace log data sets (TLDSs). The view interface described here is only available from active or complete TLDSs.

If the MAINVIEW for DB2 – Data Collector (MVDB2/DC) component is active, your administrator may have chosen to collect thread history in MVDB2/DC as input to batch reporting instead of DB2 SMF data. In this case, thread history can also be viewed from the Data Collector active trace data sets. Because the data is compressed, typically a much longer time period of thread history can be made available online than in an MVDB2 TLDS.

Accessing Thread History Data

Thread history data, whether on MVDB2 TLDSs or in MVDB2/DC active trace data sets, can be accessed from one place. Common thread interval history views provide summary performance data and exception analysis of your DB2 workloads. They display summary data by both 15-minute time intervals and connection type, and allow drilldown to the detail thread accounting data (although the drilldown is currently different for the two data sources).

To access all the views for thread interval history analysis:

1. Select the **Thrd Workload History** hyperlink on the EZDB2 Menu and press **Enter** to access the Thread History Trace Log List view (HTLOGS), as shown in Figure 94.

Trace Logs

```
08MAY2003  11:44:21 ------ MAINVIEW WINDOW INTERFACE(V4.1.07)MVDB2-------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =HTLOGS============DB2KLA===*========08MAY2003==11:44:20====MVDB2====D====3
          End                                          Number   Number   DB2
End Date  Time  Trace Id Type Trace Title              Intvls  Threads Target
21MAY2002 10:05 MVDB2DC  Sum  MVDB2 DATA COLLECTOR        10    17102 DB2K
10JUL2002 15:33 DW01     Sum  DB2 APPLICATION TRACE        6     6166 DB2K
30AUG2002 09:11 THRDHIST Sum  THREAD HISTORY              15    25422 DB2K
10SEP2002 17:39 THRDHIST Sum  THREAD HISTORY               9    14906 DB2K
```

Figure 94. HTLOGS View—Thread History Trace Log List

This view displays information about all available sources of thread accounting history. It includes each trace log data set (TLDS), as well as data from the MAINVIEW for DB2 – Data Collector active trace data sets, selected by date if available. The entries are sorted by end date and time, so typically the MVDB2/DC entries are at the top, followed by the most current THRDHIST TLDSs. TLDSs that are currently being updated are displayed in green. (For an active trace, this value is not available. If logging is in progress, 99999 is shown to indicate that the hyperlink is accessible.)

You can use this view to review the sources of thread history data and select one for workload summary analysis by hour, interval, or connection type, or drill down to detail thread accounting data. The **Number Intvls** column indicates how much time is covered by this data source. For example, 8 (15-minute) intervals is 2 hours.

Workload Summaries

First, go through the summary views. The following sections cover the drilling down to detail threads.

1. Choose an entry with recent data from the HTLOGS views.

   Of course, you can choose any earlier TLDS if you want to see past history. In this case, first sort the view by TRACE ID so that you can easily find all the THRDHIST entries. (Enter **SORT** in the command list and place the cursor in the **TRACE ID** column.)

2. Hyperlink from the **Number Intvls** column to begin your analysis of the selected data source and see a detailed summary view of all the thread data on that log, as shown in Figure 95 and Figure 96 on page 102.

   Note: This hyperlink will not be active for an active trace without logging. You can only use the hyperlink on the **Number Threads** column (described in the next section).

Thread Summary

```
16OCT2003  14:40:42 ------ MAINVIEW WINDOW INTERFACE(V4.1.09)MVDB2-------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =HTDTLZ============DB2K=====*========16OCT2003==14:40:41====MVDB2====D====1
 Thread Interval Summary..
 Date..................... 2003-10-16
 Start Time / End Time.... 12:30       14:45
 Connect Type............. ********
 Number of Threads........       6457
   DBATs..................          0
   Parallelism............          0
   Nested Functions.......          0
   LOB Access.............          0
 Abnormal Terminations....          1
 Rollbacks................        932
 Total Exceptions.........        933

 Times....................      Total    Max/Thd    Avg/Thd            Average%
 Total Elapsed............  26536.431  26452.141      4.109   100.0  ...50..100
   Total CPU..............     22.077      9.606      0.003     0.1
 In DB2 Elapsed...........     88.439      4.547      0.013     0.3
   In DB2 CPU.............     12.900      0.758      0.002     0.0
   Class 3 Waits..........     29.260      0.811      0.004     0.1
 Interval Seconds.........        900
```

Figure 95. HTDTLZ View—Thread Interval Summary History, Top Portion

This view displays a detailed summary of all the thread data on the selected thread history source. You can use this information to get an overview of your DB2 workload for the selected time frame.

The top portion shows a thread summary with elapsed and CPU time analysis. You can immediately see the number of threads, any unusual number of exceptions, the impact on the system (CPU usage), and whether the percentage of class 3 wait time, as either an average or a maximum, is out of normal guidelines.

3. If you need more detail, scroll down to the bottom portion of the view, as shown in Figure 96.

Thread Summary (continued)

```
16OCT2003  14:40:42 ------ MAINVIEW WINDOW INTERFACE(V4.1.09)MVDB2-------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =HTDTLZ============DB2K=====*========16OCT2003==14:40:41====MVDB2====D====1

Activity.................      Total    Max/Thd    Avg/Thd
Commits..................       1525          1          0
Lock Suspends............        175          1          0
Getpages.................      22146         10          3
Sync Read I/O............          0          0          0
Async Page I/Os..........          0          0          0
DDL SQL..................          0          0          0
DML SQL..................      18727          5          2
Insert/Update/Delete SQL.        721          1          0
Updates/Commit...........       0.00

Exceptions...............
Deadlocks................          0
Timeouts.................          0
Lock Escalations-Share...          0
Lock Escalations-Excl....          0
Claim failures...........          0
Drain failures...........          0
Incremental Bind Failures          0
RID Failures - Storage...          0
RID Failures - Limit.....          0
Stored Procedure Failures          0
Function Failures........          0
Hiperpool Read Failures..          0
Hiperpool Write Failures.          0
Parallel Fallbacks.......
  Ambiguous Cursor.......          0
  No ESA Sort............          0
  No Buffers.............          0
  No Storage.............          0
  RLF Limited............          0
  No Enclave.............          0
  Sysplex-No Coordinator.          0
 Sysplex-RR/SS Isolation.          0
Parallel Reduced.........
  Buffer Shortage........          0
  Sysplex Skip-No Buffers          0
  Sysplex Declare TempTbl          0
  Sysplex Reform.-Config.          0
  Sysplex Reform.-No Buff          0
```

Figure 96. HTDTLZ View—Thread Interval Summary History, Bottom Portion

Here you can see key activity indicators (as totals, averages, and maximums) and a detailed breakdown of what kind of thread exceptions have occurred.

4. Scroll back to the top of the view to access hyperlinks for further analysis by hour, interval, or connection type. Hyperlink from the **Date** field to see a summary of thread processing by hour, as shown in Figure 97.

Hourly Data

```
08MAY2003  12:53:40 ------ MAINVIEW WINDOW INTERFACE(V4.1.07)MVDB2------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =HTDTLZ===HTHOURZ==DB2KLA===*========08MAY2003==12:47:54====MVDB2====D====2
 Hour      Number   Abn.  Roll-             Total   Average   Average  AvgInDB2
 ----     Threads   Term  backs  Commits  Excepts   Elapsed       CPU   Elapsed
 15          2894     12   1429     2140     1561     3.253     0.073     1.953
 14          3272     15   1683     2595     1855     3.661     0.080     2.383
```

Figure 97. HTHOURZ View—Thread History by Hour

You can use this information to identify when workload processing problems or thread exceptions have occurred. You can sort it by any of the columns to look for particular problems like high class 3 wait times or too many exceptions. Type **SORT A** or **SORT D** on the COMMAND line and place the cursor in the column that you want to sort by.

5. Hyperlink from the **Hour** column to see thread data for the selected time period by interval and connection type, as shown in Figure 98.

Connection Types

```
08MAY2003  12:55:20 ------ MAINVIEW WINDOW INTERFACE(V4.1.07)MVDB2------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =HTDTLZ===HTINTVLC=DB2KLA===*========08MAY2003==12:47:54====MVDB2====D===1
 End    Connect      Number    Thread   Abn.  Roll-              Total  Getpage
 Time    Type       Threads  Rate/Sec  Term  backs  Commits  Excepts Rate/Sec
 15:15 TSO              570      0.63     0      0      615       45     2334
 15:15 DB2CALL           98      0.11     5     85       13       90        1
 15:15 RRSAF            660      0.73     0    571       89      571        4
 15:15 UTILITY            2      0.00     0      0      568        0      152
 15:15 DBATDRDA          10      0.01     0      2        9       10       84
 15:15 CICS              33      0.04     0      0       33        0        2
 15:30 TSO              538      0.60     0      0      588       50     2186
 15:30 DBATDRDA          11      0.01     0      3       12       11      104
 15:30 CICS              36      0.04     0      0       36        0        2
 15:30 RRSAF            626      0.70     0    571       55      571        3
 15:30 DB2CALL           95      0.11     6     83       12       89        1
 15:45 CICS               7      0.01     0      0        7        0        0
 15:45 DB2CALL           16      0.02     1     14        2       15        0
 15:45 DBATDRDA           1      0.00     0      0        2        1       15
 15:45 TSO               86      0.10     0      0       94        8      352
 15:45 RRSAF            105      0.12     0    100        5      100        0
```

Figure 98. HTINTVLC View—Thread Interval by Connection Types

You can use this information to determine which connection types were experiencing problems during a selected interval.

6. Hyperlink from the **End Time** column to see detailed information about the selected interval and connection type in the HTINTVLD view.

   This view looks the same as the HTDTLZ view that you first saw, but now it is qualified to show only the information you are interested in to analyze why the workload from this connection type was experiencing problems or an unusual pattern of activity.

7. Press **PF3** until you return to HTDTLZ to try out the other hyperlinks for alternative analysis paths.

   Next, hyperlink from the **Start Time / End Time** field to see a summary of thread history data by interval in HTINTVLZ. This view is similar to HTHOURZ, but the data is summarized by 15-minute intervals.

   Again, you can drill down on **End Time** to see the data for an interval broken down by connect type, if needed. In any of the tabular views like the HTINTVLC view, you might want to take the hyperlink on **Total Excepts** to see only the detail exception counts (instead of the hyperlink on End Time to see the full detail).

8. Press **PF3** until you return to HTDTLZ and hyperlink from the **Connect Type** field to see a summary of thread processing by connection type in HTCTYPZ.

   From here, you can drill down on one **Connect type** to see the breakdown by interval.

9. Press **PF3** until you return to HTLOGS. Select the data source from which you have been viewing summary information and hyperlink on the **Number Threads** column to access the detailed thread data behind the workload summaries.

   The data presentation of the detail data is different depending on whether the source is an MVDB2 TLDS or MVDB2/DC trace data sets.

   Note: A common view-based query function is planned for a future release.

Workload Analysis from an MVDB2 TLDS

A feature of providing the thread history application through the Application Trace is that all of the trace displays are available for navigation so that analysis can be done for any workload group down to the individual threads, or up to one selective summary display.

1. Choose a recent TLDS THRDHIST entry in the HTLOGS view. The hyperlink on **Number Threads** takes you to the main thread list display, LTRAC, as shown in Figure 99.

   This display lists all the individual thread accounting records in that trace log. There can be a lot of data, so let's try to break it down to simplify analysis.

List of Threads in a TLDS

```
BMC Software --------------   DB2 TRACE ENTRIES     -------------  RX AVAILABLE
SERV ==> LTRAC           INPUT    14:11:09  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02                                      ROW 1 OF 24 SCROLL=> CSR
EXPAND:  MON(WKLD), TOTALS, I/O-DB/TS, HISTORY        ENTRIES IN DATASET 1 - 132
         AUTH, CONNECT, PLAN, TIME, LOC, LINESEL(STRAC)
  17SEP2003               PBCRCP - SQL/SCAN/IO
  END TIME     PLAN    AUTHID  CONNECT   ELAPSED   CPU    # STMTS GETPAGE REASON
 ----------- -------- -------- -------- -------- -------- ------- ------- ------
 09:17:52.76 DSNTIA21 CIR8X    BATCH       13 s    268 ms       4     459 OK TRM
 09:18:10.33 DSNTIA21 CIR8X    BATCH       11 s    220 ms      12     168 OK TRM
 09:18:32.78 DSNTIA21 CIR8X    BATCH    8,768 ms   218 ms      12     162 OK TRM
 09:18:55.13 DSNTIA21 CIR8X    BATCH    9,225 ms   214 ms      12     162 OK TRM
 09:19:19.80 DSNTIA21 CIR8X    BATCH       11 s    216 ms      12     162 OK TRM
 09:19:44.59 DSNTIA21 CIR8X    BATCH       11 s    216 ms      12     162 OK TRM
 09:20:09.28 DSNTIA21 CIR8X    BATCH       11 s    217 ms      12     162 OK TRM
 09:20:34.83 DSNTIA21 CIR8X    BATCH       11 s    215 ms      12     162 OK TRM
 09:21:00.54 DSNTIA21 CIR8X    BATCH       12 s    218 ms      12     162 OK TRM
 09:21:24.18 DSNTIA21 CIR8X    BATCH       10 s    215 ms      12     162 OK TRM
 09:21:47.62 DSNTIA21 CIR8X    BATCH       10 s    217 ms      12     162 OK TRM
 09:22:05.21 DSNTIB21 CIR8X    BATCH    1,117 ms   112 ms      49      59 OK TRM
 09:22:16.03 DSNUTIL  CIR8X    UTILITY  2,907 ms   163 ms       0      64 OK TRM
 09:22:17.93 DSNUTIL  CIR8X    UTILITY  1,886 ms   107 ms       0      61 OK TRM
 09:22:36.33 DSNTIA21 CIR8X    BATCH       10 s    204 ms       4     357 OK TRM
 09:22:43.14 DSNTIB21 CIR8X    BATCH    1,981 ms    73 ms      49      32 OK TRM
 09:22:59.79 DSNTIB21 CIR8X    BATCH    1,439 ms    69 ms      49      30 OK TRM
```

Figure 99. DB2 Trace Entries Display (LTRAC)

2. Use the **Tab** key to place the cursor in the second expand line on the **TIME** button.

   This action summarizes the data into hourly intervals, similar to the HTHOURZ view, but now it is in a formatted trace display that cannot be customized. However, you can change a few things about the display by updating parameters, as shown in Figure 100:

   - Overtype I=1H with **I=10M** to see the data by 10-minute intervals.
   - Overtype GRAPH=NO with **GRAPH=AVG** to see a relative graphic representation of the values shown.
   - Overtype SORT=IS with **SORT=ISD** to sort the most recent interval to the top of the list.

Average Values

```
BMC Software -------------- TRACE SUMMARY BY TIME   -----------PERFORMANCE MGMT
SERV ==> TSUMT           INPUT    15:38:38  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> THRDHIST,INTVL=10M,SORT=ISD,GRAPH=AVG        ROW 1 OF 2 SCROLL=> CSR
EXPAND:  LINESEL(LTRAC), HISTORY       ENTRIES IN BUFFER  1 - 53
19SEP02                        THREAD HISTORY         19SEP02 - 17SEP02
INTERVAL     #THREADS    AVG ELAPSED      AVG CPU    AVG #STMTS    AVG GETPGS
START              38      00:05:12       464 ms          34.9          67.3
--------  |----.-----|  |----.-----|  |----.-----|  |----.-----|  |----.-----|
19:00:00   ********      <             *****         **            ******
18:50:00   ****          **            *             ***           *****
18:40:00   *             *             <             ******        ****
18:30:00   *******       <             <             *             **
18:20:00   ****          *             **            **********    ******
18:10:00   **********    **********    **********    **            **********
```

Figure 100. Trace Summary by Time Display with GRAPH=AVG

3. Press **PF7** to scroll down—and back in time.
4. Specify a temporary scroll value to move back to the most recent interval.

   ```
   SERV ==> M
   ```

   Press **PF8** to scroll to the top of the display.

5. To view totals instead of averages:

   ```
   PARM ==> THRDHIST,SORT=ISD,I=10M,GRAPH=TOT
   ```

   Averages give you a better view of application performance, while the totals show system throughput. Note how the numbers in the column headers change, as shown in Figure 101. These are the maximum values detected, and the graphs show percent of maximum: red / highlighted if > 90 percent.

Total Values

```
BMC Software -------------- TRACE SUMMARY BY TIME   -----------PERFORMANCE MGMT
SERV ==> TSUMT           INPUT    15:38:38  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> THRDHIST,INTVL=10M,SORT=ISD,GRAPH=TOT        ROW 1 OF 2 SCROLL=> CSR
EXPAND:  LINESEL(LTRAC), HISTORY       ENTRIES IN BUFFER  1 - 53
19SEP02                        THREAD HISTORY         19SEP02 - 17SEP02
INTERVAL     #THREADS    TOT ELAPSED      TOT CPU    TOT #STMTS    TOT GETPGS
START              38      03:17:59         17 s           616         2,560
--------  |----.-----|  |----.-----|  |----.-----|  |----.-----|  |----.-----|
19:00:00   ********      <             *             *******       *******
18:50:00   ****          **            ***           ******        *****
18:40:00   *             *             ****          ****          ****
18:30:00   *******       <             *****         **            **
18:20:00   ****          *             **            *****         *****
18:10:00   **********    **********    **********    **********    **********
```

Figure 101. Trace Summary by Time Display with GRAPH=TOT

6. Place the cursor on a line with a lot of activity and scroll it to the top with **PF7**.

   For example, this could be a time you need to analyze because a user reported a problem.

7. Now focus on smaller time intervals by changing the **INTERVAL(I)** value.

   ```
   PARM ==> THRDHIST,SORT=ISD,I=01M,GRAPH=TOT
   ```

   Any interval in minutes or hours is accepted, but values that divide evenly into 60 (M for minutes) or 24 (H for hours) are easier to read.

8. You can also change the sequence to sort by any column.

   ```
   PARM ==> THRDHIST,SORT=TG,I=01M,GRAPH=TOT
   ```

   For example, this sorts by TOTAL GETPAGES (use the first letters of the column headers) to help identify times of high buffer activity. Or change ISD to IS to sort by INTERVAL START but with the oldest data on top.

   (You could also tab to the column you want to sort on and press Enter.)

9. After the graphics display has helped you easily identify an interval to focus on, you may want to see the numbers behind the graphics.

   ```
   PARM ==> THRDHIST,SORT=TG,I=10M,GRAPH=NO
   ```

   The numeric display shows both averages and totals.

10. Locate an interval on the display that has at least 20 threads, or the largest you can find.

    If you are trying this step out on a test system, you might need to change the interval back to **I=1H**.

11. Use the tab key to place the cursor on that line and press **Enter**.

    You are now viewing a list of each individual thread that executed in the selected interval. A TIME keyword has been added automatically to the parameters. You have returned to the LTRAC display that you saw before, but it is reduced to a subset of threads. (See Figure 99 on page 105.)

12. Use the **Tab** key to move through the second EXPAND line to the **PLAN** button and press **Enter**.

    The panel is similar to the one you saw earlier per interval, but now the threads for the one selected interval are ***summarized by PLAN***, as shown in Figure 102.

Values for Each Plan

```
BMC Software --------------- TRACE SUMMARY BY PLAN --------------  RX AVAILABLE
SERV ==> TSUMP           INPUT    14:24:47  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> THRDHIST,TIME=1810-1820,SORT=PL,GRAPH=NO     ROW 1 OF 5 SCROLL=> CSR
EXPAND:  LINESEL(LTRAC), HISTORY               ENTRIES IN DATASET 1 - 132
 19SEP02                   THREAD HISTORY      19SEP02 - 17SEP02
           ENTRY    AVG      AVG     AVG    AVG    TOTAL    TOTAL   TOTAL  TOTAL
 PLAN      COUNT  ELAPSED    CPU   #STMTS GETPGS  ELAPSED    CPU   #STMTS GETPGS
 -------- ------ -------- -------- ------ ------ -------- -------- ------ ------
 DSNESPCS      2 5,516 ms   307 ms    3.0   70.0    11 s    615 ms      6    140
 DSNESPRR      3 5,675 ms   446 ms  100.6  109.3    17 s  1,338 ms    302    328
 DSNTIA22     12 00:01:49   281 ms   10.6  169.0 00:21:54 3,379 ms    128  2,029
 DSNTIB22     11 7,330 ms   122 ms   49.0   34.0 00:01:20 1,351 ms    539    374
 DSNUTIL       2 6,740 ms   186 ms    0.0   72.0    13 s    372 ms      0    144
 DSN8CC22      8 6,380 ms    18 ms    7.5   10.0 00:02:20   398 ms    165    220
                        *** END OF SUMMARY ENTRIES ***
```

Figure 102. Trace Summary by Plan Name

You could also have selected one of the other TSUM buttons to summarize by: **AUTHID(AUTH), CONNECTION(CONNECT)**, or **LOCATION(LOC)**.

Note: The `GRAPH=NO` change you made earlier is carried forward. You can change back to the graphic display any time by overtyping the `NO` with **`YES`**.

13. Place the cursor on one of the plans and press **Enter**.

    Now you are back at LTRAC with a list of threads executed for that one plan in the interval being investigated. A PLAN keyword has been added to the parameters.

Isolating Problems

You can continue this process of selecting, sorting, and categorizing until you have identified specific exception threads:

1. Select one thread (for example, one with a high elapsed time) and press **Enter**.

   Now you have the complete DB2 Accounting record available to you in the STRAC (Summary Trace Entry) display. Here you can see SQL counts, buffer activity, various key indicators (such as RID processing failures), lock counts, and elapsed/CPU times, as shown in Figure 103.

Complete Accounting Data

```
BMC SOFTWARE --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC            INPUT   14:25:51  INTVL=> 3  LOG=> N  TGT==> DB2K
PARM ==> BIGELAP SEQ=209                           ROW 1 OF 119 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL
        ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, RTN, DDF

STOP.....16OCT 11.16.37.94 PLAN.............DSNTEP71 TYPE.............ALLIED
START....16OCT 11.16.27.53 AUTHID............BOLDJW1 CONNECT........BATCH/TSO
ELAPSED..............10 s  ORIG PRIM AUTH.....BOLDJW1 CORR ID.....BOLDJW4A
TERM........NORMAL/DEALLOC COMMITS.................1 ROLLBACKS.............0
------------------------------------------------------------------------------
RUNTIME ANALYSIS   IN DB2     IN APPL.      TOTAL      %IN DB2(=)     TOTAL(*)
----------------   --------   --------   --------     0 ...25...50...75..100%
ELAPSED TIME          10 s      103 ms      10 s      | ==================* |
CPU TIME             172 ms      17 ms     188 ms     | <                    |
DB2 WAIT TIME         10 s                            | ==================  |
- - - - - - ACTIVITY - - - - - -      - - - - - KEY INDICATORS  - - - - - - - -
TOTAL SQL.....................63     FILTER:  ELAPSED = 10,412 (>10,000)
GETPAGES....................4,112     SQL: SELECT=     0, FETCH=    20
SYNC READS (PRLL=00) .........887     SQL: DYNAMIC(PREPARE)=    11
PREFETCH PAGES READ...........919     I/O RSP: SYNC= 5,543 us, ASYNC=    24 ms
UPDATES/COMMIT................0.0     RID LIST PROCESSING USED =     10
BFR HIT RATIOS:...VP= 56%,HP=  0%
```

Figure 103. Summary Trace Entry Display (STRAC)—Base Section

2. If you run with Accounting Class 2 or 3, don't forget to scroll down or select the **ELAPSED** button to see the graphic display of elapsed times and wait categories.
3. The other accounting detail data can be accessed by scrolling or using the expand buttons.
4. Press **PF3** to return to LTRAC, the list of completed threads.

5. Tab through the EXPAND line to the **TOTALS** button and press **Enter** to access the Trace Statistics display, as shown in Figure 104.

Totals —with the Qualifiers You've Selected

```
BMC SOFTWARE -------------    TRACE STATISTICS     -------------  RX AVAILABLE
SERV ==> TSTAT            INPUT   14:38:24  INTVL=> 3  LOG=> N  TGT==> DB2K
PARM ==> BIGELAP                                   ROW 1 OF 153 SCROLL=> CSR
EXPAND:  MON(WKLD)  HISTORY
        ACCOUNTING: ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, RTN, DDF

- - - - - - - - - - SUMMARY STATISTICS - ALL TRACE ENTRIES- - - - - - - - - -
-----TERMINATIONS ----------    ---------ACTIVITY-----------------------------
FIRST END..16OCT 09.34.27.28               TOTAL   AVERAGE   MAXIMUM   MINIMUM
LAST END...16OCT 13.57.44.24            --------  --------  --------  --------
NUMBER THREADS...........211    ELAPSED  12:08:02  00:03:27  07:20:52     10 s
COMMIT/ROLLBK.....210/.....1    ELP-DB2  00:50:24     14 s   00:01:45    851 ms
NORMAL TERM.............208    CPU         55 s     260 ms  9,606 ms     24 ms
-- NEW USER...............0    CPU-DB2     40 s     188 ms    758 ms     15 ms
-- DEALLOC................207    WAITS    00:47:29     14 s      36 s     240 ms
-- APPL END...............1    SQL        13,050        61        63          4
-- RESIGNON...............0    GETPAGES  852,770     4,041     2,088         27
-- DBAT INACT.............0    SYNC RDS  184,661       875     1 019          0
-- IFI READ...............0    PFCH PGS  188,995       895     1 257          0
ABNORMAL TERM.............1    UPD/COMT        0         0         0          0
IN DOUBT TERM.............2    BFR HIT RATIOS:.....VP= 56%,HP=  0%
- - - - - - KEY INDICATORS - - - - - - - - - - - - - - - - - - - - - - - - - -
SQL: SELECT=     0, FETCH= 4,143
SQL: DYNAMIC(PREPARE)= 2,279
I/O RSP: SYNC= 7,110 us, ASYNC=    37 ms
LOCK SUSPENSIONS =    158
RID LIST PROCESSING USED =  2,070
```

Figure 104. Summary Statistics for All Trace Buffer Entries (TSTAT)

The TSTAT (Trace Statistics) display summarizes the data from the selected threads you were just viewing. It provides an easy way to evaluate a problem area that is broader than just one single thread execution.

The values you are looking at now summarize the performance of the one plan you previously selected. Look at the **PARM** field in the third line. You will see the selections you made by selecting lines in TSUMT **(TIME=hhmm—hhmm)** and TSUMP **(PLAN=xxxxxxxx)**.

6. To see all activity starting at a specific time, change (or add) the TIME parameter with just a start time.

   ```
   PARM ==> THRDHIST,TIME=hhmm,PLAN=xxxxxxxx
   ```

7. Press **PF3** to return to LTRAC.

   The parameter change is still in effect.

8. To see all activity for a generic group of plans, change (or add) the PLAN parameter using mask characters in the plan name (plus sign for one position, asterisk for multiple positions).

   ```
   PARM ==> THRDHIST,TIME=hhmm,PLAN=xxx*
   ```

   The list now shows all plans starting with 'xxx'.

We have gone through examples of using TIME and PLAN, but you can also narrow your view of the workload in the same way using the other selections.

A|AUTHID= To select by user or user group **(TSUMA)**

C|CONNECT=	To select by connection name **(TSUMC)** (TSO, BATCH, DB2CALL, cicsid, imsid)
L|LOC=	To select by DDF location **(TSUML)**
D|DAY=	To select by relative day when the trace spans days (1 = date of first accounting record in the trace buffer) (can also be specified as a range of days)

Remember also that if you need to check whether there were any unusual conditions at a particular time, you can go to the Journal log (LOG or PF5) and do a FIND for that time to view DB2 messages and MAINVIEW for DB2 exception messages.

9. Press **PF3** to return to the HTLOGS view.

Workload Analysis from MVDB2/DC Active Trace Data Sets

Because the data available in the trace data sets usually consists of many more threads, two hyperlinks are provided for detailed analysis.

1. Return to the HTLOGS view and choose an entry (if available) with **MVDB2DC** as the TRACE ID.
2. Hyperlink from the **Number Threads** column to see an hourly summary of the thread accounting records in the the active trace data sets for that day, as shown in Figure 105.

Hourly Summary

```
BMCSftwr.THACINTV    --  THREAD ACCOUNTING BY PERIOD   --       09/25 21:24:57
FILTER : NONE        --                                --       TRACING : NO
                     --   DATA SOURCE : DOMB-ACTIVE    --      ,MORE:     +
-------------------------------------------------------------------------------
   ZOOMS    : A-AUTH  C-CORR  N-CONN  P-PLAN  L-SUMMARY LIST  S-DETAIL LIST
   DS GROUP : DSNDBD           MEMBER : DBDK
   DB2 SSID : DBDK 5.1                            TOTAL THREADS :           201
              -------------TOTAL------------ -------AVERAGE------- ----PERCENT---
   PERIOD   THREADS ROLLBK TIMEOT PARAFAIL GETPAGE  APPL ELAPSED DB2 ELAPSED IN
   BEGIN      DDF   ABNORM DEADLK RID FAIL GETP/RIO DB2  ELAPSED CPU, I/O, LOCK
   -------- ------- ------ ------ -------- -------- ------------ --------------
+, 09/25/03      18      0      0        0      3.8 00:00:00.019
   21:00:00       0     10      0        0      4.9 00:00:00.014  9.3 34.8  0.0

+, 09/25/03      26      0      0        0      0.0 00:00:00.059
   20:00:00       0     23      0        0      N/P 00:00:00.006  5.1  0.0  0.0

+, 09/25/03      26      0      0        0      0.0 00:00:00.087
   19:00:00       0     23      0        0      N/P 00:00:00.007  4.2  0.0  0.0
```

Figure 105. THACINTV Report

3. Scroll through this hourly summary until you find an hour with some interesting data that you want to investigate further.
4. In the Data Collector reports, use the ZOOM commands to navigate for drill down.

   Each report has a list of available zooms at the top of the report. Enter any of the one-character zoom command characters by overtyping any + (plus sign) on the left side of the report (use the **Tab** key to move from one to the next). For example, in THACINTV, enter **P** to see a summary by plan of the threads in that hour (THACPLAN).

5. On THACPLAN, use the **L** zoom to see a summary list of the individual threads (THACLIST), as shown in Figure 106.

List of Individual Threads

```
BMCSftwr.THACLIST    --   THREAD ACCOUNTING SUMMARY    --       09/25 21:29:59
FILTER : INT QUL     --                                --       TRACING : NO
                     --   DATA SOURCE : DOMB-ACTIVE    --      ,MORE:     +
-------------------------------------------------------------------------------
   ZOOMS    : S-DETAIL                                    EXPANDS : Q-QUALIFIERS
   DS GROUP : DSNDBD          MEMBER : DBDK
   DB2 SSID : DBDK 5.1                          TOTAL THREADS :            5
                                                                 EXCEPTIONS:
   ACCTG    AUTH     CONN         DB2 ELAPSED     DML      GETPAGE  TO RF RB AT
   TIMESTP  PLAN     CORR         DB2 CPU         COMMITS  GETP/RIO DL IB PF IT
   -------- -------- ------------ --------------- -------- -------- -- -- -- --
+, 09/25/03 IKOJQC   DB2CALL      00:00.033189          12       28  0  0  0  0
   21:23:45 TMUC2AV  IKOJQC01     00:00.007734          25      7.0  0  0  0  0

+, 09/25/03 IKOJQC   DB2CALL      00:00.048008           1        7  0  0  0  0
   21:23:45 TMUC2AV  IKOJQC01     00:00.002882           2      3.5  0  0  0  0

+, 09/25/03 IKOJQC   DB2CALL      00:00.019832           2        8  0  0  0  0
   21:23:45 TMUC2AV  IKOJQC01     00:00.001572           2      2.7  0  0  0  0
```

Figure 106. THACLIST Report

6. On THACLIST, use the **S** zoom to see the complete accounting data for one thread.
7. You can investigate other zooms later. For now, press **PF3** to return to HTLOGS.
8. Hyperlink on the **Trace ID** column of an entry where the ID is MVDB2DC.
   A qualification panel is provided to allow selection before thread data is displayed, as shown in Figure 107.

Select the Threads You Want to See

```
DOMELFIL/I                      Local Filters                        19:54:22
Command ====> ____________________________________________________________


The following filters are in effect. Press Enter without update to continue.

Source of data  . . . : Subsystem DC41
Start time  . . . . . : Based on activation
Duration  . . . . . . : 000 days 08 hrs  00 mins 00 secs (rolling)
Period length . . . . : 000 days 01 hour 00 mins 00 secs    Periods:     8
Filtered by . . . . . : No qualifiers




Select one of the following.  Then press Enter.
                                                              Set from
_ 1. Data Source      - Select data from monitor or data set *Default*
  2. Interval         - Select, format data by time          *Default*
  3. Qualifier        - Select data by qualifier value       *Default*
```

Figure 107. THACQLTV Report Qualification Panel

You can qualify by various DB2 identifiers, narrow the time period, or even access older data saved in archive data sets.

Note: If you have very large active trace logs with high thread volumes, it is recommended that you use interval filtering to to select what you really need to see. This reduces the amount of data to be processed, speeds the return of the data, makes it easier to analyze, and avoids possible storage problems.

9. Select option **3** to specify various qualifiers, as shown in Figure 108.

Specify Qualifiers

```
DOMELFIQ/I                Local Filters/Qualifiers              LINE 1 OF 23
Command ====> _____________________________________________ Scroll ===> CSR_


Type the following information to include or exclude data.  Then Exit.
  - one or more exact values to include or exclude (wildcards are allowed)
  - one or more qualifier lists to include or exclude -- lists begin with )
  -  ? to display existing qualifier lists
  -  ?xxxxxxx to view, modify, or create a qualifier list named )xxxxxxx
  - Qualifiers marked with (t) are the only ones applicable to tracing.
                                                                          I/
 System ID (SMF ID)  . ________  ________  ________  ________              _
 DB2 Subsystem ID  . . _____    _____    _____    _____                    _
 Authorization ID (t)  ________  ________  ________  ________              _
 Plan Name (t) . . . . DSNTEP71  ________  ________  ________              I
 Connection ID (t) . . ________  ________  ________  ________              _
 Operator ID (t) . . . ________  ________  ________  ________              _
 Correlation ID (t). . ____________    ____________    ____________        _
 DBRM/Package ID . . . ________  ________  ________  ________              _
 Buffer Pool ID  . . . ________  ________  ________  ________              _
 Collection ID . . . . ________________  ________________                  _
```

Figure 108. Qualifiers Panel

Note: The DB2 subsystem you selected from MVDB2 is no longer defined. Once you select this panel, you must enter at least one DB2ID, which will usually be the one you started analyzing. However, in data sharing systems you may want to broaden the analysis to the members in the group.

Optionally add other qualifications by plan, Auth ID, or any other ID shown on this panel.

10. Press **PF3** once and then select option **2** to specify a start time and duration.

11. Press **PF3** again and then select option **1**.

    Normally you will not need to use this panel. But if the data you are interested in has already been archived, you can enter the archive data set DSN here to access it. Later, you may want to choose the Archive Directory option on the main MVDB2/DC panel, which shows you the available archive files and the time period each covers. Bypass both of these suggestions for now.

12. Press **PF3** to go back again and now press the **Enter** key without specifying an option.

    You are back to the THACINTV report as shown before, but it only shows the data that you just selected. From here you can drill down to the threads that you want to review.

Analyze DB2 I/O

It is also possible to start other, more detailed, system-wide traces to assist in workload analysis. However, authorization is required for such traces because of the potential overhead, so you may not be able to perform the setup for this dialog. In this case, just browse through the instructions so you understand the features offered. Then you can request such a trace when you need it from your system administrator.

In this example, you analyze I/O usage per page set (table spaces and index spaces). If you run DB2 with Accounting Class 2 or 3, increases in the average I/O wait times may indicate a problem that should be investigated. You can see this value in the ELAPSED TIME ANALYSIS section of TSTAT (select any time period or application of interest), or you may want to do a trend analysis from historical data kept in Performance Reporter tables.

Run a System I/O Trace

To run a system I/O trace:

1. From the Primary Option Menu, select the **I/O** option.

   ```
   OPTION ===> 7
   ```

   The I/O Analysis Options panel is displayed, as shown in Figure 109.

Trace I/O Events

```
BMC Software --------------  I/O ANALYSIS OPTIONS   ------------  RX AVAILABLE
COMMAND ==> 7                                                  TGT==> DB2G

Display Buffer Pool I/O Data:

  1  I/O BY DB/TS   - Display Realtime Data by Database / Tablespace
  2  I/O BY BPOOL   - Display Realtime Data by Buffer Pool
  3  I/O BY VOLUME  - Display Realtime Data by Volume
  4  I/O BY DATASET - Display Realtime Data by Data Set

Display I/O Data from a Trace:

  5  CURRENT TRACES - List Current I/O Traces: n Active, nn Complete
  6  HISTORY TRACES - List All History I/O Traces

Start a DMR I/O trace:

  7  START TRACE    - Review Primed Options / Activate (Start Trace Panels)

Print SMF/GTF I/O Traces

  8  DB2 TRACE      - Print Instructions
```

Figure 109. I/O Analysis Options Panel

2. Go to the Start Trace request panels.

   ```
   COMMAND ===> 7
   ```

   You need to collect the I/O events for a short time period.

   Note: If you do not need to access the following I/O analysis online, read the instructions in Option 8 about writing DB2 I/O trace data to SMF/GTF and printing reports.

3. The required keywords to start an I/O trace are primed in the Start DB2 Trace Request panel.

   Specify any additional options necessary for this exercise and start the trace. (Possible additions to primed options are in bold type.)

   ```
   PARM     ==>  IOhhmmss             Trace ID
   TYPE     ==>  D                    Detail trace
   STORAGE  ==>  1000K                Display buffer size
   LOGTRAC  ==>  Y                    Log to dynamically allocated data set
   TITLE    ==>  DB2 I/O SYSTEM TRACE Descriptive title
   START    ==>  hh:mm:ss             Cover peak period
   STOP     ==>  15                   Stop after 15 minutes
   DB2AUTH  ==>  +                    Trace all threads
   Detail Trace Options ==> *         Next panel shows I/O events selected
      SQL    ==>  N                   SQL events turned off to reduce overhead
      I/O    ==>  Y                   Specify I/O events
      TRBUFF==>  50                   Increase buffers to trace many threads
   ```

4. Let the trace run to completion.

Analyze I/O by Page Set

To analyze I/O by page set:

1. Return to the I/O Analysis application (Option 7 from the Primary Option Menu).
2. Browse the collected trace data.

   ```
   COMMAND ===> 5        (Current Traces)
   ```

   Or, if you logged the trace:

   ```
   COMMAND ===> 6        (History Traces)
   ```

3. Select the trace you requested (traceid IOhhmmss).

   ```
   LC       (Line Command)
    S       (for Select)
   ```

   The first panel of trace data, a list of all threads executed in this time period, is displayed. However, go first to the summary data for the whole trace.

4. Tab through the EXPAND line to the **I/O-DBTS** button and press **Enter**.

   This summarizes all I/O activity by page set for the total DB2 system. It shows total (synchronous and asynchronous) I/O measurements, as shown in Figure 110.

Summarized I/O Events

```
BMC Software --------------    I/O Analysis-HT      -----------PERFORMANCE MGMT
SERV ==> DBIO            INPUT    11:02:14  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SORT=DB,TOTAL                          LINE    1 OF   19 SCROLL=> CSR
EXPAND:  PLAN, AUTH, BPOOL, TIME, CONNECT, LOCATION
EXPAND:  LINESEL(DBTS), CATALOG
OPTION:  TOTAL, SYNC, ASYNC

19MAR01                    CIR2.DB2G.JQSIO.MAR19.T1818.V01
DATA     TABLE              I/O   I/O   MAX    AVG
BASE     SPACE             COUNT    %  IOWAIT IOWAIT
-------- --------      -------- ----- --ms-- --ms-- 0 ...20...40...60...80
DSNDB01  DBD01                4   5.6     89     34 | ********              |
DSNDB01  DSNSCT02             1   1.4     28     28 | *******               |
DSNDB01  DSNSPT01             1   1.4     17     17 | ****                  |
DSNDB01  SCT02                2   2.8     38     31 | *******               |
DSNDB01  SPT01                4   5.6    351     95 | ******************** |
```

Figure 110. I/O Analysis by Database / Table Space Display (DBIO)

You can see the number and percent of I/O per table space and index space, as well as the average and maximum I/O sort times. You can select only the synchronous or asynchronous (prefetch) I/Os by tabbing to the **OPTION** line. Only the synchronous I/Os directly affect application response time.

5. Tab to the **AVG IOWAIT** column and press **Enter** to sort the highest average delays to the top of the display.

   The parameter is changed to `SORT=AI`. A high average I/O wait may point out possible poor DASD response times.

6. Tab to the **MAX IOWAIT** column and press **Enter** to sort the highest maximum delays to the top of the display.

   The parameter is changed to `SORT=MI`. A high maximum value may point out an occasional contention problem that could be masked in the averages.

7. Tab to the **I/O COUNT** column and press **Enter** to sort the highest number of I/Os to the top of the display.

   The parameter is changed to `SORT=IC`. Index spaces with high I/O counts may be good candidates for a separate buffer pool configured for index data.

Analyze I/O by Application

I/O problems may be caused by DASD response or contention problems, or they may be caused by the application just doing too many I/Os. To analyze I/O by application:

1. Tab to the **PLAN** button and press **Enter** to access the I/O Analysis by Plan display, as shown in Figure 111.

I/O Summarized by Plan

```
BMC Software --------------   I/O Analysis-Plan     -----------PERFORMANCE MGMT
SERV ==> DBIOP           INPUT    11:29:20  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SO=PL,TOTAL                          LINE    1 OF    3 SCROLL=> CSR
EXPAND:  PKG/PGM, LINESEL(DBIO), CATALOG
OPTION:  TOTAL, SYNC, ASYNC

19SEP02                    CIR2.DB2G.JQSIO.SEP19.T1818.V01
                           I/O   I/O   MAX    AVG
PLAN                      COUNT    %  IOWAIT IOWAIT
--------                --------- ----- --ms-- --ms-- 0 ...20...40...60...80
DSNTIA31                      29  40.8     89     19 | ****                 |
DSNTIB31                       6   8.5     38     25 | ******               |
RXDB2                         36  50.7   1028     80 | ******************** |
```

Figure 111. I/O Analysis by Plan Display (DBIOP)

   This summarizes all the I/O collected by the trace by plan.

2. Tab to the **I/O %** column and press **Enter**.

   This sorts the applications with the highest amount of I/O to the top.

3. Line select one plan.

   This returns you to the DBIO display by DB/TS, but shows only the table spaces accessed by that plan.

4. Try out some of the other summarizations, selection, and sorting options to narrow the focus of the displays.

   Of course, all the other trace displays are available, including the Lock and I/O Summary per thread (STRAC) and the detail I/O events (DTRAC).

The next section covers printing I/O reports.

Print Workload Reports

Printing workload reports is usually done from the DB2 tables of performance data supported by Performance Reporter. This gives you long-term history and trending, as well as the full flexibility of SQL for defining your own reports in addition to the predefined set. See “Reports from DB2 Tables” in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

Also, selective or total accounting reports, in either a short or a long format, can be printed from DB2 accounting records that are extracted from Data Collector archive files or one or more SMF files. For example, you can select from a specific time period or by plan, authorization ID, and so on. The reports also can be summarized by various criteria. See “Data Collector Reporting Facilities” or “Reports from SMF” in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information. A summary of batch printing capabilities is in “Printing Reports” on page 147.

However, this data is often not available to answer questions about the workload until the next day. The batch trace print facility is designed to fill the need for quick reports. All the trace summary report formats are available, in any combination.

There are different types of input:

- One or more trace log data sets

  For example, of the Thread History trace.

- Archived trace logs (without reloading to VSAM)

  For example, thread history from two weeks ago.

- Data Collector archive files
- An SMF history file containing DB2 Accounting records or I/O trace IFCIDs
- The live SMF data sets
- A GTF trace data set

If you are writing accounting data to the Data Collector trace data sets, you can also run the Data Collector reports against any of the archived files, or against the active trace data sets. See “Data Collector Reporting Facilities” in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

The examples in this dialog are made with the THRDHIST and system I/O traces.

To print a workload report:

1. From the Primary Option Menu, select the **HISTORY TRACES** option.

   ```
   OPTION ===> 5
   ```

2. Locate an entry with a TRACEID of THRDHIST and select it for print.

   ```
   LC       (Line Command)
    P       (for PRINT)
   ```

   The Batch Trace Print panel where you can specify options to print one batch report is displayed, as shown in Figure 112.

Specify Options

```
BMC Software ------------ BATCH TRACE PRINT ----------------  PERFORMANCE MGMT
COMMAND ===>                                                    TIME --- 15:00

Update job ==> N (Y/N - update job statement)                (END to edit JCL)
Title line 1 ==>
Title line 2 ==>

Data Selection:
 From date  ==> 16MAR2001  Time  ==> 1125
 To   date  ==> 17MAR2001  Time  ==> 1412

   PLAN     ==>
   AUTHID   ==>
   CONNECT  ==>
   CORR     ==>
   LOC      ==>
   DB2PKG   ==>

REPORT SELECTION:
   LTRAC ==> NO                          (YES/NO)
   STRAC ==> NO                          (NO,ALL,SUMMARY,section1,section2..)
   DTRAC ==> NO                          (YES/NO)
   POPUP ==> NO                          (NO/ALL/SQL/event1,event2,....)
   TSUM  ==>          (A/C/L/P/T)        SORT     ==>       (for any TSUMx)
   TSTAT ==> NO       (SUMMARY/ALL/NO)   INTERVAL ==> 1H    (for TSUMT only)
   DBIO  ==>          (X/A/C/F/L/P/T/xx) IOSORT   ==>       (for any DBIOx)
                                         IOINTVL  ==> 10M   (for DBIOT only)
```

Figure 112. Batch Trace Print Panel

You can also use the sample JCL **DZTBPRNT** to tailor and submit a set of reports. This JCL is set up so that it can invoke several sample report members that explain many of the available print options.

3. If this is the first time you are using this option, you may want to update your job statements first (Update Job ==> **Y**).

4. Fill in the options for a report.

```
REPORT ==> traceid    Specify any name. Used as the output DD.
DDNAME ==>            Optional.
TITLE1 ==> any title  Optional. Centered in first report header.
TITLE2 ==> any title  Optional. Centered in second report header.
```

   Data Selection is optional, but can be used to reduce the amount printed. The date and time fields are primed from the trace log data set.

```
REPORT SELECTION:
 LTRAC  ==>  N
 STRAC  ==>  N
 DTRAC  ==>  N
 POPUP  ==>  N
 TSUM   ==>  T            SORT     ==>
 TSTAT  ==>  SUMMARY      INTERVAL ==> 30M
```

5. Press **Enter** to validate your specifications.

   These options are saved in your profile and used to initialize the fields the next time this panel is requested.

6. Press **PF3** to review the generated JCL in edit mode.

   The options you specified are inserted into a pattern job DZJPTRAC in BBPROF. You may want to copy this JCL into your own UBBPROF data set and modify it.

7. Check the other options and add if desired; for example:

```
TSUM=T,I=30M,GRAPH=TOT
```

   Add the option to graph the totals instead of printing values. There are many other options that cannot be shown on the panel. Refer to “Printing a Trace” in Volume 2 of the *MAINVIEW for DB2 User Guide*.

8. Submit the job.

```
COMMAND ===> SUB
```

   If you prefer, you can **SAVE** or **CANCEL** the JCL.

9. Press **PF3** to return to the Batch Trace Print panel.

   You can make another request now if desired.

When the job completes, review the output. This gives you a graphic summary of total DB2 activity for the selected time period in 30-minute intervals, followed by a summary of the activity.

Here is another example:

```
LTRAC ==> Y
STRAC ==> SUMMARY          (Add ,DDF if DDF is active)
```

This provides the complete DB2 Accounting information per thread. You may want to use the data selection options to limit the output.

To print an I/O report from the system I/O trace log or from an SMF/GTF data set that has DB2 I/O IFCIDs 6 - 10:

```
DBIO=X      Summarize by database/table space
DBIO=XP     Summarize by database/table space/plan
DBIO=PX     Summarize by plan/database/table space
```

All the other summarization options of AUTHID, connect, buffer pool, location, and time are also available.

Chapter 6. Using RxD2 with MAINVIEW for DB2

In this practice session, you

1. Learn how to use RxD2/FlexTools with MAINVIEW for DB2 for SQL prototyping.
2. Access DB2 Catalog and PLAN_TABLE information or invoke EXPLAIN directly from your terminal session for either local or remote DB2 systems (remote access is through DDF connections from a local DB2).

Note: This practice session takes approximately one hour to complete.

Improve Performance with SQL Prototyping

SQL prototyping can be a valuable tuning exercise at two different times in the development cycle:

- When an application is first being developed and the basic performance characteristics of the SQL statements need to be validated against the design criteria.
- When a poorly performing SQL statement has been identified in an application and improvements are being sought.

RxD2 FlexTools provides a simple method both to execute and EXPLAIN SQL statements directly from the program source. There are often several possible methods to code an SQL statement, and the trick is to find the one with the best performance characteristics. Modifying and executing these variations while running a detail trace can simplify this task and document the results for you.

Begin by ensuring that RxD2 is accessible from your terminal session:

Note: You can access RxD2 only from a terminal session running under ISPF or MAINVIEW Alternate Access. Also, to run this scenario, your terminal session must be on the same MVS system as your source libraries and the DB2 system.

1. Go to the MAINVIEW for DB2 Primary Option Menu.

   You will see an RX option in the middle of the panel if RxD2 is installed.

2. Request this option:

   ```
   OPTION ===> RX         RxD2 FlexTools
   ```

   The RxD2 Primary Option Menu is displayed, as shown in Figure 113.

RX Is Available

```
BMC Software ------------- Primary Option Menu ---------- RxD2 FlexTools 2.1
Option ===>                                               Target ===> DB2G
                                                          Userid ---- BOLMXW2

                          DB2 Resource Administration
--------------------------------------------------------------------------------
   1  Plans                                9  Storage Groups
   2  Packages                             10 RLF
   3  Tables                               11 DDF
   4  Table Spaces                         12 Synonyms
   5  Partitions                           13 SYSCOPY
   6  Indexes                              14 Authorization by User
   7  Index Partitions                     15 Authorization by Resource
   8  Databases                            16 Stored Procedures

DB2 Application Functions            General Facilities
-------------------------            ------------------
   A1 Execute SQL                       C  DB2 Commands
   A2 DDLGEN for Tables                 D  Defaults
   A3 EXPLAIN PLAN_TABLE                T  Tutorial
   A4 EXPLAIN SQL from Edit (EXPL)      N  What's New
   A5 Execute SQL from Edit (TEX)       X  Exit
```

Figure 113. RxD2 Primary Option Menu

3. Press **PF3** to return to MAINVIEW for DB2.

When RxD2 is installed, you will also see a short message `RX AVAILABLE` at the top right of many other displays.

Start a Trace

To set up the trace for your tests:

1. Start a detail trace qualified by your AUTHID.

   ```
   OPTION ===> ST          Start Trace
   ```

   The default for a detail trace includes an SQL trace, which is usually sufficient information. If you also need to analyze data access by table space, you may want to add SCANS or I/O. Include LOCKS only for specific lock analysis, since this is very expensive. Log the trace so you can print reports later if desired.

   If you have any questions about starting a trace request, go back through the first part of the practice session in Chapter 4, “Tuning an Application with Trace” on page 65.

2. Check that the trace has started correctly.

   ```
   OPTION ==> CT          Current Traces
   ```

   Press **Enter** until your trace request appears in the list and shows as active.

Test a Statement

To start testing:

1. From the Primary Option Menu, or any command line, select RxD2.

   ```
   OPTION ===> RX         RxD2 FlexTools
   ```

   or

   ```
   COMMAND ===> RX        RxD2 FlexTools
   ```

2. Enter ISPF/PDF Edit.

   ```
   OPTION ===> A5       Execute SQL from Edit (TEX)
   ```

3. Select your program source file and member in the normal way, and then locate the statement you want to test.

   (If you have the DB2 IVP installed, you can use the DSNSAMP member DSN8MCA and choose the first statement.) (Use FIND 'EXEC SQL'.)

4. Choose the statement for execution.

   ```
   COMMAND ===> TEX
   ```

   Place the cursor on the statement text and press **Enter**.

   If you execute this from a library with an unknown source type (for example DSNSAMP), you are asked to define whether the text is in COBOL, PL/I, and so on. Otherwise, the statement is parsed immediately and primed in a panel to prepare for execution, as shown in Figure 114.

Initiate Execution

```
BMC Software ------------------- Execute   SQL --------------------------------
Command ===>                                          TARGET ===> DB2G

Location           ===> DB2G
Maximum Fetches    ===> 99999
Default SQL Action ===> COMMIT   (COMMIT,ROLLBACK)
Current SQLID      ===> BOLMXW3

Enter the SQL statement below, and press ENTER to execute:
-------------------------------------------------------------------------------
SELECT CREATOR, NAME, TYPE, DBNAME, TSNAME FROM SYSIBM.SYSTABLES ORDER BY CREAT
R,NAME
```

Figure 114. Execute SQL Panel

5. Determine the maximum number of FETCHes that should be executed.

   ```
   MAXIMUM FETCHES ==> 20
   ```

   The default is 20. If you change it here, it affects only this one execution. You also can change the default in the Defaults option (RxD2/FlexTools Primary Option Menu).

6. Define whether you want to COMMIT or ROLLBACK.

   ```
   DEFAULT SQL ACTION ==> COMMIT
   ```

   The default is COMMIT. In both cases, the thread is terminated at completion so that an accounting record is cut for each execution.

7. Modify the SQL text if necessary.

   Review and modify the SQL statement text before execution as dynamic SQL. Host variables are not supported (they are replaced by question marks in the text), so you may have to edit in appropriate values for the test. You also can delete or add clauses. It is not necessary to edit out blanks. The text will be flowed together for execution.

8. Change the current SQLID if necessary to qualify a table name or edit it into the text.

9. Press **Enter** to submit the SQL statement for execution.

   Output is returned in a scrollable display, each row separated by asterisks and the row number, followed by one line per column, as shown in Figure 115.

Results of Execution

```
BMC Software ----------------- Execute SQL Output ---- Row 145 to 180 of 1,174
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Location  . . . . . : DB2G
--------------------------------------------------------------------------------
ROW # 25 ******************** 5 COLUMNS
CREATOR            = BOLMXW2
NAME               = MWTTBLA
TYPE               = T
DBNAME             = MWDBTEST
TSNAME             = MUTSPCA
ROW # 26 ******************** 5 COLUMNS
CREATOR            = BOLMXW2
NAME               = MWTTBL3H
TYPE               = T
DBNAME             = MWDBTEST
TSNAME             = MUTSPC3H
ROW # 27 ******************** 5 COLUMNS
CREATOR            = BOLMXW2
NAME               = MWTTBL3I
TYPE               = T
DBNAME             = MWDBTEST
TSNAME             = MUTSPC3I
ROW # 28 ******************** 5 COLUMNS
CREATOR            = BOLMXW2
NAME               = MWTTBL3J
TYPE               = T
DBNAME             = MWDBTEST
TSNAME             = MUTSPC3J
ROW # 29 ******************** 5 COLUMNS
CREATOR            = BOLMXW2
NAME               = MWTTBL3X
TYPE               = T
DBNAME             = MWDBTEST
TSNAME             = MUTSPC3X
ROW # 30 ******************** 5 COLUMNS
CREATOR            = BOLMXW2
NAME               = MWTTBL3Z
TYPE               = T
DBNAME             = DSNDB04
TSNAME             = H3TTBL1
```

Figure 115. Execute SQL Output Panel

10. Repeat the modification and execution of the statement for as many iterations as you need.

11. Press **PF3** to return to your edit session.

If you wish, you can now choose another SQL statement to test.

EXPLAIN a Statement

You can EXPLAIN any statement while in edit. This can be very useful when you are first creating an SQL statement. You do not need to EXPLAIN every iteration you are testing now, since the MAINVIEW for DB2 trace captures the EXPLAIN data created for the dynamic SQL. Choose one to try out now so you know how it works:

1. Choose the statement for execution.

   COMMAND ===> **EXPL**

   Place the cursor on the statement text and press **Enter**.

   You may be asked to define the source type, just as for TEX. Then the statement is parsed and primed in a panel to prepare for EXPLAIN, as shown in Figure 116.

   Note: You must have a PLAN_TABLE allocated for your AUTHID or, if changed, the current SQLID.

Initiate EXPLAIN

```
BMC Software ---------------------- EXPLAIN ----------------------------------
Command ===>                                            TARGET ===> DB2G

Location         ===> DB2G
Catalog Prefix   ===> SYSIBM
Current SQLID    ===> BOLMXW
                 (Plan_Table must exist for this SQLID)

Enter the query number to use ===> 601


SQL statement to be explained:
------------------------------------------------------------------------------
SELECT DSN8410.DEPT.DEPTNO, DEPTNAME, MGRNO, PROJNO, PROJNAME FROM DSN8410.DEPT
FULL OUTER JOIN DSN8410.PROJ ON DSN8410.DEPT.DEPTNO = DSN8410.PROJ.DEPTNO
```

Figure 116. EXPLAIN PLAN_TABLE Qualifier Panel

2. Specify the query number to identify this iteration.

   Type the query number to use ===> **1**

   The default is 1.

   Review / modify the SQL statement text before EXPLAINing it. Host variables are replaced with parameter markers (questions marks) in a format acceptable to EXPLAIN.

3. Press **Enter** to submit the SQL statement to be EXPLAINed.

   The EXPLAIN output is returned in a formatted, scrollable display, as shown in Figure 117.

Results of EXPLAIN

```
BMC Software ----------------- EXPLAIN PLAN_TABLE ------------ Row 1 to 2 of 2
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Catalog Prefix   ===> SYSIBM
Location         ===> DB2G
PLAN_TABLE  . . . . : BOLMXW.PLAN_TABLE

Commands: SORT (Q,PL,PK,CO,DT)
LC CMDS:  P  (plan detail)            T  (table detail)
          PK (package detail)         X  (index detail)
          M  (more detail)
LC QNO   STP BLK MXSEQ PLAN     PGM      COLLECTION         DATE     TIME
-- ----- --- --- ----- -------- -------- ------------------ -------- --------
     601   1   1     0          RXSEL1M  RXD2               20010317 14491881
   Method: First Table Accessed
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 1
   Table:  DSN8410.DEPT                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: None                     Composite: None
-------------------------------------------------------------------------------
     601   2   1     0          RXSEL1M  RXD2               20010317 14491881
   Method: Merge Scan Join          Full Outer Join
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 2
   Table:  DSN8410.PROJ                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: JOIN                     Composite: JOIN
-------------------------------------------------------------------------------
****************************** Bottom of data ******************************
```

Figure 117. EXPLAIN PLAN_TABLE Output Panel

4. Most of the important information is available on this first display, but you can use line command **M** to see more detail.

5. Use the line commands to quickly access information about the DB2 objects accessed.

   ```
   LC       (Line Command)
    T       (for Table detail)
    X       (for Index detail)
   ```

   All table/index catalog information upon which DB2 bases its access path selection is easily found with these dialogs.

6. Repeat the modification and EXPLAIN of the statement for as many iterations as you need.

7. Press **PF3** to return to your edit session.

If you wish, you can now choose another SQL statement.

Compare Test Results

To find out which of the test SQL versions ran best:

1. From edit, press **PF3** several times to return to MAINVIEW for DB2.
2. Look at your trace data.

   ```
   OPTION ===> 5    HISTORY   Historical Trace Data Sets
   ```

   If you logged the trace, locate your data set here (SORT US, then LOCATE userid).

   If not, go to Option 4, Current Traces.
3. Select the trace for viewing.

   ```
   LC     (Line Command)
    S     (S to select the trace data)
   ```

   The first display **(**LTRAC**)** lists one line for each test execution (and DB2 accounting record). You can see immediately which test executions had the best performance as measured by elapsed and CPU times, as well as number of GETPAGEs.
4. Select one line for further analysis by tabbing to that line and pressing **Enter**.

   You now have the complete DB2 Accounting information at your finger tips **(**STRAC). This provides you with statistics on wait times, locking, buffer pool activity, and I/O.
5. To compare this data to that from another iteration, use **PF10** and **PF11** to move to previous or next accounting record displays, without returning to the LTRAC list.
6. Tab through the expand buttons and press **Enter** to view summaries of SQL statistics, scans, I/O, or locks by table space (if traced).
7. To identify which SQL statement text was executed for this test iteration, tab to the **DETAIL** expand button and press **Enter**.

   You are now viewing a chronological list of detailed events that occurred in DB2 while processing this statement **(**DTRAC display**)**.

   For dynamic SQL, this provides you with critical data to help you relate the performance data in the trace with the test SQL you executed.
8. Tab to the **BIND-TEXT** event and press **Enter** to see the complete text of the SQL statement executed, as shown in Figure 118.

Complete Text

```
BMC Software --------------   DETAIL TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> DTRAC           INPUT    17:30:58  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> IO111256,SEQ=1,LEVEL=2                       ROW 1 OF 1 SCROLL=> CSR

START: 11:17:10 AUTH: BOLMXW2  PLAN: RXDB2    CORR: BOLMXW2      CONN: DB2CALL
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
-------------- -------- -------- -------- -----------------------------------
 BIND-TEXT       14.892                   *TYPE=DYNAMIC  TEXT=SELECT * FROM SY+
================================================================================
SELECT * FROM SYSIBM.SYSPACKAGE  WHERE NAME LIKE '%'
```

Figure 118. DTRAC BIND-TEXT Pop-Up Display

9. Press **PF3** to return to DTRAC.

10. Tab to the **EXPLAIN** event and press **Enter** to see the dynamic SQL EXPLAIN data, as shown in Figure 119.

EXPLAIN Data

```
BMC Software --------------   DETAIL TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> DTRAC           INPUT    12:43:58  INTVL=> 5  LOG=> N  TGT==> DB2HSR
PARM ==> MYLOCKS,SEQ=3,LEVEL=3                      ROW 1 OF 18 SCROLL=> CSR
EXPAND:  CATALOG
START: 12:32:57 AUTH: BOLSMR4  PLAN: RXDB2    CORR: BOLSMR4      CONN: DB2CALL
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
------------- -------- -------- -------- -----------------------------------
 EXPLAIN          5.173                  *PLAN=RXDB2    COST(1.4)
================================================================================
QUERY NUMBER: 115           EXPLAIN DATE..: 2002-09-19  12:33:0284
GROUP MEMBER: DB2H          STATEMENT TYPE: SELECT
PROGRAM NAME: RXSEL1M       COLLECTION ID.: RXD2
VERSION NAME:
WHEN_OPTIMIZ: AT BIND TIME USING DEFAULT VALUES
--------------------------------------------------------------------------------
BLKNO:   1        SEQNO:   1    MXSEQNO:   0
METHOD: FIRST TABLE
ACCESS: INDEX SCAN                          PREFETCH: NONE
 COL_FN:
 PAGE RANGE SCAN:  NO
TSLOCK: IS
TABLE: DSN8710.EMP                    CORRELATION:
INDEX:                                 MATCHING:
--------------------------------------------------------------------------------
BLKNO:   1        SEQNO:   1    MXSEQNO:   1
METHOD: FIRST TABLE
ACCESS: MULTINDEX/UNION        INDEX ONLY    PREFETCH: NONE
 COL_FN:
 PAGE RANGE SCAN:  NO
TSLOCK: IS
TABLE: DSN8710.EMP                    CORRELATION:
INDEX: DSN8710.XEMP1                  MATCHING: 1         KEYS
--------------------------------------------------------------------------------
```

Figure 119. DTRAC EXPLAIN Pop-Up Display for DB2 5.1 and Above

EXPLAIN Data

```
BMC Software --------------   DETAIL TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> DTRAC           INPUT    17:31:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> IO111256,SEQ=1,LEVEL=2                     ROW 1 OF 6 SCROLL=> CSR
EXPAND:  CATALOG
START: 11:17:10 AUTH: BOLMXW2  PLAN: RXDB2    CORR: BOLMXW2      CONN: DB2CALL
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
------------- -------- -------- -------- -----------------------------------
 EXPLAIN         19.708                  *PLAN=RXDB2    COST(4,061.4)
================================================================================
       QUERY NUMBER  115           TIMESTAMP      1996-03-05 11:17:1856
       GROUP MEMBER  DB2G          COLLECTION ID  RXD2

 BLK  SEQ DESCRIPTION
---- ---- -------------------------------------------------------------------
   1    1 METHOD: FIRST TABLE
          ACCESS: SEQUENTIAL SCAN          PREFETCH: SEQ
          TSLOCK: IS
          TABLE:  SYSPACKAGE                                  CREATOR: SYSIBM
          INDEX:                                              CREATOR:
          SORT:   NONE
```

Figure 120. DTRAC EXPLAIN Pop-Up Display for DB2 4.1 and 3.1

If you need to review the catalog information, the **EXPLAIN** expand button takes you back to RxD2 to a display of the first table accessed.

11. If needed, tab to any SQL statement and press **Enter** to see the detail row statistics.

    This can show you how many rows were accessed and whether the predicate was Stage 1 or 2.

12. Tab to the **LOCK SUMMARY** event to see an analysis of locking and lock states (tracing lock events is not necessary to get this).

13. As with STRAC, you can use **PF10** and **PF11** to move between the events produced by this test iteration.

Print Results

If you logged the trace, you may now want to print a report for desk analysis or a team SQL review:

1. Press **PF3** until you are back in the History Traces display.

2. Select the print option for your log data set.

   ```
   LC   (Line Command)
    P   (for Print)
   ```

   A panel on which you can define your print options is displayed. For more details, refer to "Print a Trace Report" on page 94.

Recommended print options for SQL prototyping are

```
LTRAC=Y                    One line identifier
STRAC=SUMMARY              DB2 accounting record summary
DTRAC=Y                    Detail events
POPUP=(BIND-TEXT,EXPLAIN)  SQL text and EXPLAIN data
```

You may want to add

```
NEWPAGE=TRAN               Start a new page per test execution
LEVEL=3                    To see all detail events
```

You may also want to print the detail summaries of STRAC in a separate report (they cannot be produced in the same report with DTRAC entries).

```
LTRAC=Y                    One line identifier
STRAC=ALL                  Complete accounting with detail summaries
```

Access DB2 Catalog and PLAN_TABLE Information

DB2 performance is dependent on three factors:

- How the DB2 system is configured (maximum threads, buffer pool, EDM pool, logging, and so on)
- The DB2 workload (SQL optimization, lock contention, I/O patterns, and service times, and so on)
- The DB2 objects themselves (tables, table spaces, indexes, plans) and the status information stored in the DB2 catalog about them

MAINVIEW for DB2 and other performance monitors mainly present data about the first two categories. Catalog and PLAN_TABLE access is usually a completely separate function. The ability to access RxD2/FlexTools directly from your BBI Terminal Session provides this information whenever you need it (subject to standard DB2 security).

Accessing the RxD2 Primary Option Menu

Access to DB2 data with RxD2 is provided from any MAINVIEW product that runs in full-screen mode, not just MAINVIEW for DB2. This includes

- AutoOPERATOR and FOCAL POINT—an operator or systems programmer can check the status of DB2 resources that may be affecting availability
- MAINVIEW for CICS—a CICS systems programmer or applications manager can investigate plans and tables used from CICS
- MAINVIEW for IMS—an IMS systems programmer or DBA can investigate plans and tables used from IMS

As described in the first session, the RxD2/FlexTools Primary Option Menu is available from most MAINVIEW applications running in full-screen mode.

- From the MAINVIEW for DB2 Primary Option Menu:

  ```
  OPTION ===> RX
  ```

- From any command line:

  ```
  COMMAND ===> RX
  ```

- From any MAINVIEW for DB2 or MAINVIEW for IMS service display:

  ```
  SERV ===> RX
  ```

Now all the capabilities of RxD2 are available for use.

Accessing EXPLAIN for Currently Executing SQL

When a DB2 application is running too long, you may want to investigate the current SQL statement being executed. The MAINVIEW for DB2 detail user (DUSER) display provides hyperlink expand buttons to perform an EXPLAIN or access existing PLAN_TABLE EXPLAIN data.

To access EXPLAIN data for currently executing SQL:

1. Access the DUSER display:

   a. Return to the Primary Option Menu.
   b. Choose Option **2**—ANALYZERS.
   c. Line select **USERS** from the list of Analyzer Display Services.
   d. Tab to an active thread and press **Enter** to access DUSER.

   Check that there is an active SQL statement displayed, as shown in Figure 121.

Expand to EXPLAIN ==>

Current SQL Statement ==>

```
 BMC Software --------------   DETAIL USER STATUS    -------------  RX AVAILABLE
 SERV ==> DUSER           INPUT    17:32:09  INTVL=> 3  LOG=> N  TGT==> DB2G
 PARM ==> MXW3                                 ROW     1 OF    96 SCROLL=> CSR
 EXPAND:  MON(USER), UTRAC, ST(START TRACE), LOCKE, EXPLAIN,  PT
          ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, SPAS, DDF
 CURRENT........17:32:09.23 PLAN..............DSNESPRR TYPE..............ALLIED
 START..........17:22:14.06 AUTHID.............MXW3 CONNECT..........TSO/TSO
 ELAPSED...........00:09:55 ORIG PRIM AUTH........MXW3 CORR ID.....MXW3
 STATUS.............IN-DB2 COMMITS.................0 ROLLBACKS..............0
 ------------------------------------------------------------------------------
 RUNTIME ANALYSIS   IN DB2     IN APPL.      TOTAL      %IN DB2(=)     TOTAL(*)
 ---------------    --------   --------   --------     0 ...25...50...75..100%
 ELAPSED TIME         430 ms   00:09:55   02:36:54     | <****************** |
 CPU TIME              64 ms      44 s       44 s      | <                    |
 DB2 WAIT TIME      00:09:14                           | ==================   |
 - - - - - - ACTIVITY - - - - - -      - - - - - KEY INDICATORS  - - - - - - -
 TOTAL SQL......................2     I/O RSP: SYNC= 3,352 us, ASYNC=    12 ms
 GETPAGES..................243,322
 SYNC I/O (PRLL= 0) ........24,225
 PREFETCH...................27,644
 UPDATES/COMMIT................0.0
 BFR HIT RATIOS:...VP= 90%,HP=  0%
- - - - - - - - - - - - - - -SQL STATEMENT ANALYSIS - - - - - - - - - - - - - - -
STATEMENT #:    193                   STATEMENT TYPE:  OPEN
ACTIVE IN DB2               CPU TIME: 1,897 ms     ELAPSED TIME: 00:01:06
Package/DBRM: DSNESM68  (DYNAMIC)           PLAN ISOLATION LEVEL: RR
PROCEDURE/UDF/TRIGGER:  DSN8SPAS_TEST
  SELECT DISTINCT TBCREATOR, TBNAME, NAME, COLTYPE, LENGTH, SCALE, NULLS, DEFAUL
T FROM SYSIBM.SYSCOLUMNS C, SYSIBM.SYSCOLAUTH CA, SYSIBM.SYSTABAUTH TA WHERE C.T
BCREATOR = USER OR C.TBCREATOR = 'PUBLIC' OR (CA.GRANTEE = USER AND CA.TNAME = C
.TBNAME) OR (C.TBNAME = TA.TTNAME AND TA.GRANTEE = USER)
```

Figure 121. User Detail Status Display (DUSER)—Base Section

2. Select the **EXPLAIN** expand button.

   A qualifier panel is displayed with the SQL text from DUSER.

   If the DB2 target is on the same MVS as your terminal session, RxD2 accesses it directly (see the TARGET field). If the DB2 target is on a remote MVS, RxD2 accesses it through DDF. The TARGET name shown now is the local DB2 your RxD2 session is connected to (set in the Defaults panel) and LOCATION identifies the remote DB2.

3. If necessary, modify the query number and PLAN_TABLE owner (current SQLID).

```
Enter the query number to use ===> 1
Current SQLID                 ===> your userid
```

   Note: If your SQL has unqualified table names, you may need to set up special PLAN_TABLEs with the appropriate prefixes so that the current SQLID also can provide the proper table name qualifications.

4. Press **Enter** to invoke EXPLAIN, as shown in Figure 122.

EXPLAIN Output for Current SQL Statement

```
BMC Software ----------------- EXPLAIN PLAN_TABLE ------------ Row 1 to 2 of 2
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Catalog Prefix   ===> SYSIBM
Location         ===> DB2G
PLAN_TABLE  . . . . : BOLMXW.PLAN_TABLE

Commands: SORT (Q,PL,PK,CO,DT)
LC CMDS:  P  (plan detail)            T  (table detail)
          PK (package detail)         X  (index detail)
          M  (more detail)
LC QNO   STP BLK MXSEQ PLAN     PGM      COLLECTION         DATE     TIME
-- ----- --- --- ----- -------- -------- ------------------ -------- --------
     601   1   1     0          RXSEL1M  RXD2               19951102 14491881
   Method: First Table Accessed
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 1
   Table:  DSN8410.DEPT                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: None                     Composite: None
-------------------------------------------------------------------------------
     601   2   1     0          RXSEL1M  RXD2               19951102 14491881
   Method: Merge Scan Join          Full Outer Join
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 2
   Table:  DSN8410.PROJ                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: JOIN                     Composite: JOIN
-------------------------------------------------------------------------------
****************************** Bottom of data ********************************
```

Figure 122. EXPLAIN PLAN_TABLE Output Panel

This option can be used for both static and dynamic SQL. However, for static SQL, the results may be different from the access path chosen by the DB2 Optimizer at BIND time.

5. Press **PF3** until you return to DUSER.

6. If this is a static SQL statement, select the **PT** expand button.

   A qualifier panel is displayed primed with the query number (statement number) and program (DBRM or package).

7. Your user ID is primed as the PLAN_TABLE owner.

   You may need to change this specification before proceeding.

8. Press **Enter** to view the PLAN_TABLE EXPLAIN data.

Accessing EXPLAIN from a Trace

The previous practice session, “Improve Performance with SQL Prototyping” on page 124, showed how both SQL text and EXPLAIN information is captured in a detail trace for dynamic SQL. Neither of these events is provided by DB2 for static SQL. However, direct hyperlinks to RxD2 provide equivalent information.

To access EXPLAIN data from a trace:

1. Access a detail trace that includes static SQL:
   a. From the Primary Option Menu, choose Option **4**—Current Traces (or Option **5**—History Traces, if you prefer).
   b. Line select the detail trace to view the LTRAC display of traced threads.
   c. Tab to a trace entry with several SQL statements and press **Enter** to see the accounting data for that thread (STRAC display).

2. Select the SQL Summary section by tabbing to the **SQL** button in the SUMMARIES EXPAND line and pressing **Enter**.

   A summary of all SQL executed by that thread is displayed, as shown in Figure 123.

SQL Summary

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,SQL,SORT=PGM                   ROW 1 OF 18 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

- - - - - - - - - - - - - SQL SUMMARY (DETAIL TRACE ONLY) - - - - - - - - - - - -

  STMT                   AVG.     %      AVG.     %    SORT  -- PAGES SCANNED --
  TYPE    STMT  COUNT   ELAPSED  ELAP    CPU     CPU   RECS  INDX DATA WORK  REF
------- ----- -----  -------- -----  -------- -----  ----  ---- ---- ---- ----
SELECT   3228      1     25 ms   2.7  1,930 us   0.3     0     2    1    0    0
SELECT   3347      2     11 ms   2.4  4,047 us   1.5     0    11    4    0    0
OPEN     3565      6    172 us   0.1    170 us   0.2     0     0    0    0    0
FETCH    3578     11  1,986 us   2.3    782 us   1.6     0    19    3    0    0
CLOSE    3664      6    192 us   0.1    149 us   0.2     0     0    0    0    0
SELECT   3671      6  1,776 us   1.1  1,091 us   1.2     0    12    0    0    0
SELECT   3283      1  2,643 us   0.3  1,888 us   0.3     0     1    0    0    0
OPEN     3299      1    109 us   0.0    107 us   0.0     0     0    0    0    0
FETCH    3313      2    907 us   0.2    855 us   0.3     0     1    0    0    0
CLOSE    3334      1    142 us   0.0    141 us   0.0     0     0    0    0    0
OPEN     3456      1    693 ms  74.1    414 ms  74.9     8    23 1187    2    0
FETCH    3468      5    440 us   0.2    322 us   0.3     0     0    0    6    0
SELECT   4803      1  1,269 us   0.1  1,121 us   0.2     0     2    0    0    0
PGM: P025D100     44            83.9            81.0     8    71 1195    8    0

SELECT   1239      1  1,040 us   0.1  1,040 us   0.2     0     2    1    0    0
OPEN     1263      1     66 ms   7.1     47 ms   8.6   172    13    6    9    0
FETCH    1273     87    201 us   1.9    177 us   2.8     0     0    0    2    0
CLOSE    1324      1    250 us   0.0    250 us   0.0     0     0    0    0    0
OPEN     1333      1     15 ms   1.6     14 ms   2.6     7     6    4    5    0
FETCH    1343      5    254 us   0.1    254 us   0.2     0     0    0    2    0
SELECT   1375      3  1,746 us   0.6  1,165 us   0.6     0     0   12    0    0
CLOSE    1393      1    126 us   0.0    126 us   0.0     0     0    0    0    0
PGM: P025D200    100            11.4            15.0   179    21   23   18    0

SELECT    389      1     38 ms   4.2     18 ms   3.4     0    10    3    0    0
OPEN      482      1    135 us   0.0    134 us   0.0     0     0    0    0    0
FETCH     489     10    459 us   0.5    302 us   0.5     0     1    0    0    0
PGM: P025D300     12            4.7             3.9     0    11    3    0    0

** TOTALS ***    156                                    187   103 1221   26    0
```

Figure 123. SQL Summary (STRAC)

3. Select one of the static SQL statements to view the execution statistics for that SQL statement, as shown in Figure 124.

SQL Statistics

```
BMC Software --------------  DETAIL TRACE ENTRY ---------------PERFORMANCE MGMT
SERV ==> STRAC           INPUT    10:22:51  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TEST3,SEQ=000017,SQL                ROW     1 OF    18 SCROLL=> CSR
EXPAND:  SQLTEXT(EXPLAIN)

STATEMENT:  350  SELECT                            NUMBER OF EXECUTIONS:      2
PLAN:       DSNESPRR                ELAPSED:  AVERAGE 2,794 us   TOTAL 5,588 us
PROGRAM:    DSNTIAUL                CPU:      AVERAGE 1,271 us   TOTAL 2,543 us
LOCATION: DB1D
PACKAGE:  SAJUYH2I                               --------- AVERAGES ---------
                                                    INDEX  SEQ-DATA  SEQ-WORK
                                                 --------  --------  --------

          ROWS PROCESSED ALL TYPES                      4         2         0
          ROWS PROCESSED CORRECT TYPE                   4         2         0
          ROWS QUALIFIED BY DM (STAGE 1)                3         0         0
          ROWS QUALIFIED BY RDS (STAGE 2)               0         0         0
          ROWS INSERTED                                 0         0         0
          ROWS UPDATED                                  0         0         0
          ROWS DELETED                                  0         0         0
          PAGES SCANNED                                 8         2         0
         REFERENTIAL INTEGRITY PROCESSING:
          PAGES SCANNED                                 0         0         0
          ROWS DELETED/SET NULL                         0         0         0
```

Figure 124. SQL Statement Pop-Up Display (STRAC)

4. Tab to the **SQLTEXT(EXPLAIN)** expand button and press **Enter**.

   Note: If this statement is not static SQL, the button is not highlighted. Try another statement.

   This displays the complete static SQL statement text from the appropriate plan or package catalog table. From this panel, you can choose to

   - Access existing EXPLAIN data in a PLAN_TABLE

     Your user ID is primed as the PLAN_TABLE owner. You can change it before making the request.

   - EXPLAIN the text and access the RxD2 EXPLAIN display for the statement (although this may not show the access path actually used that was chosen at BIND time)

     A qualifier panel is first displayed primed with the SQL text and query number 1. Your user ID is primed as the PLAN_TABLE owner. You can change these specifications before executing the EXPLAIN. If any host variables are in the statement, they are replaced by parameter markers (question marks) to make it EXPLAINable.

   - Execute the statement

     You can specify the maximum number of fetches, whether to COMMIT or ROLLBACK, and change the SQLID if necessary before execution.

     If any host variables are in the statement, they are replaced by question marks, and the text is presented on the Execute SQL panel to allow for tailoring into an executable format.

   Note: The same panels you have viewed previously for the RxD2 EXPLAIN are shown.

5. Press **PF3** to return to STRAC.
6. Select the **DETAIL** expand button to view the detail events that occurred within the life of the thread, as shown in Figure 125.

Detail Events

```
BMC Software --------------  DETAIL TRACE ENTRY --------------PERFORMANCE MGMT
SERV ==> DTRAC           INPUT    10:21:48  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TEST3,SEQ=000017,LEVEL=2              ROW     1 OF    35 SCROLL=> CSR
EXPAND:  LINESEL(DETAIL), HISTORY
START: 09:17:11 AUTH: JEK1     PLAN: DSNTIB21 CORR: DB221REQ     CONN: BATCH
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
-------------- -------- -------- -------- ----------------------------------
CREATE-THD        0.000    45 ms 4,492 us
 PLAN-ALLOC       0.045                    ISOLATION=CS ACQ=USE   REL=COMMIT
PKG-ALLOC         0.065                   *DSNESPCS ISO=CS ACQ=USE   REL=COMIT
PREPARE   350     0.069 1,361 ms    26 ms *RC(   0) C=DT         D/X   PS(  10)
 BIND-TEXT        0.070                   *TYPE=DYNAMIC  TEXT=SELECT * FROM DS+
 EXPLAIN          0.078                   *PLAN=DSN8IC22 COST(4.6)
 EDM-REQ          1.302   123 ms 3,964 us  DB=00000258
OPEN      524     1.489   204 us   202 us *RC(   0) C=DT
FETCH     532     1.489 2,058 ms 6,247 us *RC(   0) C=DT         D/X   PS(   2)
 OPEN-TS          2.235                    DB=DSN8D21A TS=DSN8S21D
 OPEN-TS          3.352                    DB=DSN8D21A TS=XDEPT3
FETCH     532     3.549    35 ms   441 us *RC(   0) C=DT         D/X
FETCH     532     3.615   354 us   353 us *RC(   0) C=DT         D/X
FETCH     532     3.616   335 us   335 us *RC(   0) C=DT         D/X
FETCH     532     3.620   354 us   353 us *RC(   0) C=DT         D/X
FETCH     532     3.621   386 us   387 us *RC(   0) C=DT         D/X
FETCH     532     3.672   386 us   387 us *RC(   0) C=DT         D/X
FETCH     532     3.673   337 us   337 us *RC(   0) C=DT         D/X
```

Figure 125. Detail Trace Events (DTRAC)

7. Scroll down with **PF8** until you see a static SQL statement and select it to view the SQL statement pop-up display.

   This looks much like the one you saw from the SQL Summary, but is only for one execution of that statement.

   The same SQLTEXT(EXPLAIN) expand button is available here.

8. Press **PF3** until you return to the Primary Option Menu.

Accessing Other Catalog Data with Direct Hyperlinks

Analyzer displays of DB2 database objects (DBATs and DBTS), as well as the detail trace dynamic SQL EXPLAIN pop-up display, provide direct hyperlinks to the related catalog information on selected objects.

To hyperlink directly to related catalog data:

1. From the Primary Option Menu, select Option **7**—I/O Analysis and then select Option **1**— I/O by DB/TS.
2. Line select one of the table spaces.

   DBIOD—I/O Analysis by Data Set is displayed and the parameter field is primed with the name of the selected database and table space, as shown in Figure 126.

Selected Object

```
BMC Software -------------  I/O Analysis-Dataset   -------------  RX AVAILABLE
SERV ==> DBIOD            INPUT   18:33:03  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TOTAL,SO=TS,DBTS=(DSN8D41A,DSN8S41E)  LINE    1 OF    4 SCROLL=> CSR
EXPAND:  I/O-DB/TS, I/O-BPOOL, I/O-VOL, LINESEL(DBTS), CATALOG
OPTION:  TOTAL, SYNC, ASYNC, CACHE


DATA     TABLE    DS/      I/O   I/O   MAX    AVG
BASE     SPACE    PRT     COUNT    %  IOWAIT IOWAIT
-------- -------- ---  -------- ----- --ms-- --ms-- 0 ...20...40...60...80
DSN8D41A DSN8S41E 004         7  25.0     98     58 | **************       |
DSN8D41A DSN8S41E 003         5  17.9     36     25 | ******               |
DSN8D41A DSN8S41E 001         9  32.1     48     16 | ****                 |
DSN8D41A DSN8S41E 002         7  25.0    112     45 | ***********          |
****************************** END OF DATA ***********************************
```

Figure 126. I/O Analysis by Data Set (DBIOD)

3. Select the **CATALOG** expand button to access a primed DB2 Table Space Administration qualifier panel; then press **Enter** to display catalog information for the selected table space, as shown in Figure 127.

Table Space Catalog Data

```
BMC Software ---------------- Show Table Space --------------- Row 1 to 1 of 1
Command ===>                                          SCROLL ===> PAGE
                                                      TARGET ---- DB2G
Location         ===> DB2G
Catalog Prefix   ===> DB2G.SYSIBM

Commands: SORT (DB,TS, column no.)      GU (Group Utility generator)
LC CMDS:  A  (authorization)            Q  (generate QUIESCE JCL)
          C  (generate COPY JCL)        R  (generate REORG JCL)
          D  (drop table space)         RC (generate REORG and COPY JCL)
          KD (generate CHECK DATA JCL)  S  (show partitions)
          KX (generate CHECK INDEX JCL) T  (generate RUNSTATS JCL)
          L  (list tables within)       Y  (SYSCOPY recovery info)
LC
-- ------------------------------------------------------------------------
   DSN8S41E Status: AVAILABLE
       Database:    DSN8D41A  Segment Size: 0        Lock Rule:  PAGE
       Creator:     BOLBPL1   Page Size(K): 4        Erase Rule: N
       Partitions:  4         Using:        BPO      Close Rule: N
       Tables:      1         Active Pages: 120
       Statstime:   1996-02-01-11.05.32.584702       Space: 0KB
```

Figure 127. Table Space Catalog Display

From this display, you can use the line commands to browse all the other related catalog information for tables (L), partitions (S), indexes (per table), and so forth.

4. Press **PF3** until you are back at the DBIOR display.
5. Select the **CATALOG** expand button again.

   Here there are no selected objects. The table space qualifier panel is presented so you can choose which table space or group of table spaces you want to view, as shown in Figure 128.

Specify Qualifiers

```
BMC Software ---------- DB2 Table Space Administration ------------------
Command ===>                                            TARGET ===> DB2G

Location         ===> DBOG
Catalog Prefix   ===> SYSIBM
Catalog Table . . . : SYSIBM.SYSTABLESPACE
Specify at least one table space qualifier.

Column               Qualifier (e.g. NULL, ^='AB', >123, AB++CD*)
-------------        ------------------------------------------------------

* DBNAME         ===> DSN*
  TSNAME         ===>
  CREATOR        ===>
  DBID           --->
  OBID           --->
  BPOOL          ===>          (Buffer Pool ID)
  PARTITIONS     --->
  LOCKRULE       ===>          (A-any,P-page,T-table,S-tablespace,R-row)
  ERASERULE      ===>          (Y,N)
  CLOSERULE      ===>          (Y,N)
  STATUS         ===>          (A-available, C-check pending, I-incomplete)
  TABLES         --->
  ACTIVE PAGES   --->

                    Press ENTER to process, END to exit
```

Figure 128. Table Space Qualifier Panel

For example, in the DBNAME field, type **DSN*** to display all system table spaces.

Note: When you are finished with this exercise, press **PF3** several times to exit the EXPLAIN function. You can initiate the next exercise from any MAINVIEW for DB2 service.

Accessing Specific Objects in the Catalog

At other times, you may need information about a specific DB2 object or user that is being shown on a display of one of the BBI products. For example, you might be on a tabular display like LTRAC where a direct hyperlink is not available. Instead of writing the name down on a piece of paper to later type in a selection panel, the BBI—RxD2 interface provides subcommands that prompt you for immediate entry of the object name. If you decide not to type the name, you are presented with a qualifier panel that allows you to select a list of these objects.

To view details about a specific plan:

1. Type

   ```
   COMMAND ===> RX PL planname
   ```

   If you are in a display with a COMMAND line (for example, when viewing a DB2 message in the Log Display), you can type the plan name directly after PL on the COMMAND line.

   If you are in a display with a SERV line, just type **RX PL** and press **Enter**. You are prompted at the bottom of the screen for the plan name (for example, in the STRAC trace display).

2. Press **Enter** to go to RxD2.

   The TARGET is set to the local DB2 from your Defaults panel.

   To access a different DB2 system on the same MVS as your terminal session, specify the correct **target name** on the qualifier panel. To access a remote DB2 system (if connected with DDF), keep the TARGET pointing to any local DB2 and specify the **location name** of the remote DB2. You also can change the catalog prefix to view an alternate catalog.

3. If you specify a plan name, RxD2 displays the DB2 Plan Administration panel with one line of information about that plan, as shown in Figure 129.

Information for One Plan

```
BMC Software ---------------- DB2 Plan Administration -------- Row 1 to 1 of 1
Command ===>                                            SCROLL ===> CSR
                                                        TARGET ---- DB2G
Location         ===> NEW YORK
Catalog Prefix   ===> SYSIBM

COMMANDS: SORT (column no.)
LC CMDS:  A (plan authorization)        F (free plan)
          B (bind plan functions)       P (show plan detail)
          C (list plan collections)     R (rebind plan)
          D (show plan dependencies)    S (show DBRMs and SQL statements)

            -STATUS--                   ---- BIND ----- ---- BIND OPTIONS ----
LC PLANNAME VALD OPER CREATOR  BOUND BY  DATE    TIME   ISOL VALD ACQ   REL
-- -------- ---- ---- -------- -------- ------ -------- ---- ---- ----- ------
   DSNSTO1  Y    Y    BOLSMR2  BOLSMR2  950817 15353898 CS   DFER USE   COMMIT
****************************** BOTTOM OF DATA ********************************
```

Figure 129. DB2 Plan Administration Panel

All the line commands are available to access more detailed information.

```
LC     (Line Command)
 A     (to show plan authorizations)
 C     (to list plan collections)
 D     (to show plan dependencies)
 P     (to show plan detail)
 S     (to show DBRMs and SQL statements)
```

For example, you may need to see the plan dependencies or authorizations to find out why an application isn't running.

The plan detail and static SQL statement text are valuable when analyzing a detail trace for application tuning.

4. To view the EXPLAIN results for a specific plan:

   ```
   COMMAND ===> RX PT planname (owner)
   ```

   If you don't enter the operands, you are prompted at the bottom of the screen. You can specify the PLAN_TABLE owner, or default to your user ID.

   The EXPLAIN results are displayed on a panel from which catalog data about the accessed tables and indexes can be accessed directly.

   ```
   LC     (Line Command)
    P     (to show plan detail)
    T     (to show table detail)
    X     (to show index detail)
   ```

   For example, use this command when investigating a production plan that has been showing up in exception reports with increased run times. All the dependencies and statistics are available starting from this one screen, as shown in Figure 130.

EXPLAIN Results for One Plan

```
BMC Software ----------------- EXPLAIN PLAN_TABLE ------------ Row 1 to 2 of 2
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Catalog Prefix   ===> SYSIBM
Location         ===> DB2G
PLAN_TABLE  . . . . : BOLMXW.PLAN_TABLE

Commands: SORT (Q,PL,PK,CO,DT)
LC CMDS:  P  (plan detail)            T  (table detail)
          PK (package detail)         X  (index detail)
          M  (more detail)
LC QNO   STP BLK MXSEQ PLAN     PGM      COLLECTION         DATE     TIME
-- ----- --- --- ----- -------- -------- ------------------ -------- --------
     601   1   1     0          RXSEL1M  RXD2               20010317 14491881
   Method: First Table Accessed
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 1
   Table:  DSN8410.DEPT                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: None                     Composite: None
-------------------------------------------------------------------------------
     601   2   1     0          RXSEL1M  RXD2               20010317 14491881
   Method: Merge Scan Join          Full Outer Join
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 2
   Table:  DSN8410.PROJ                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: JOIN                     Composite: JOIN
-------------------------------------------------------------------------------
****************************** Bottom of data ******************************
```

Figure 130. EXPLAIN PLAN_TABLE Output Panel

5. To view the details about a specific table:

   ```
   COMMAND ===> RX TB tablename | OBID
   ```

   If you don't enter the operand, you are prompted at the bottom of the screen. You can specify either the table name or OBID.

6. If you specify a table name, RxD2 displays the Show Table Objects panel, as shown in Figure 131.

Information for One Table

```
BMC Software --------------- Show Table Objects -------------------------
Command ===>                                              TARGET ---- DB2G

Catalog Prefix   ===> DB2G.SYSIBM
Location  . . . . . :
Name  . . . . . . . : SYSIBM.SYSTABLES
Type  . . . . . . . : TABLE

LC CMDS:  S (show detail)

LC
-- ------------------------------------------------------------------------

   COLUMNS        Columns In TABLE  39
------------------------------------------------------------------------
   TABLESPACE     Tablespace: DSNDB06.SYSDBASE
                  Rows: 300      Pages: 300      TS Pct: 75%
------------------------------------------------------------------------
   INDEXES        Indexes Defined For This TABLE  2
                  Primary Key Columns: 2
------------------------------------------------------------------------
   RELATIONS      Referential Integrity Relationships
                  Parent: 1     CHILD:
                  Check: OK
------------------------------------------------------------------------
   CHECKS         Check Constraints: 0
------------------------------------------------------------------------
   DEPENDENCIES   Plans Depending On This TABLE
------------------------------------------------------------------------
                  Audit: NONE  Edproc:          Validproc:
                  Statstime:  0001-01-01-00.00.00.000000
                  Compressed: -1%
```

Figure 131. Show Table Objects Panel

The S line command is available to access more detailed information. It provides access to related table space, column, index, key, referential constraint, or plan dependency data.

7. To view the details about a specific index:

   ```
   COMMAND ===> RX IX indexname | OBID
   ```

   If you don't enter the operand, you are prompted at the bottom of the screen. You can specify either the index name or OBID.

8. If you specify an index name, RxD2 displays the Show Index panel, as shown in Figure 132.

Information for One Index

```
BMC Software -------------------- Show Index ---------------- Row 1 to 1 of 1
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Catalog Prefix   ===> DBOG.SYSIBM
Location  . . . . . : DBOG

Commands: SORT (IX,TB)                GU (Group Utility generator)
LC CMDS:  D  (drop index)             C  (generate CHECK INDEX JCL)
          I  (show index parts)       R  (generate REORG JCL)
          K  (show index key columns) T  (generate RUNSTATS JCL)
LC
-- ------------------------------------------------------------------------
   SYSIBM.DSNDTX01           *** RUNSTATS RECOMMENDED ***       DBID: 6
     Created As:  Primary    On Table:  SYSIBM.SYSTABLES        OBID: 61
     Subpages:    1          Cluster             Unique First Keys: -1
     Bufferpool:  BP0          Defined: N        Unique Full Keys:  -1
     Close:       N            Status:  N        Levels of Index:   -1
     Key Columns: 2            Ratio:   0%       Leaf Pages:        -1
     Type:        2          Statstime: 0001-01-01-00.00.00.000000
-- ------------------------------------------------------------------------
```

Figure 132. Show Index Panel

All the line commands are available to access more detailed information.

```
LC    (Line Command)
 I    (to show index parts)
 K    (to show index key columns)
```

Chapter 7. Printing Reports

These scenarios teach you how to print both your online and offline reports.

In this practice session, you

1. Print an online history trace and export an online windows-mode view for offline review.
2. Print offline traces from a trace log data set or SMF records.
3. Print offline Performance Reporter reports from SMF data, MVDB2/DC archive data sets, and DB2 tables.

This practice session takes approximately one hour to complete.

Print Online Reports

You can both print online history traces and export online windows-mode views for offline review.

History Traces (Thread Data)

In previous exercises, you learned how to run a trace and view it online. However, depending on the results, you may want to have a hardcopy for further analysis. Batch reports can also be valuable tools during an application review meeting.

Note: This section describes printing a trace, but you may also want to look at the accounting reports produced from DB2 trace records written to SMF, from MVDB2/DC archive data sets, or from DB2 tables loaded from one of these sources. See "Performance Reporter Reports" on page 160 and the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

To begin this exercise:

1. From the Primary Option Menu, select the **HISTORY TRACES** option.

   ```
   OPTION ===> 5
   ```

   This panel not only provides access to view the trace data online but also offers several line commands to simplify management of the trace log data sets:

   W Show the options used for this trace
   P Generate the JCL to print a batch report
   D Delete this data set from the trace directory
   E Reset the log data set for reuse
   V Verify that the directory entry matches the data set contents
   N Add a new data set to the directory (moved from another system)
   A Archive the data set (only if an archive started task was specified)
   F Free a data set currently being read

Usually you will need only W(SHOW), D(DELETE), and P(PRINT). We are going to concentrate now on P. You can try the others when you need those functions.

All Data per Traced Thread

To print a trace report showing all data per traced thread:

1. The history traces display shows the most recent traces at the top, but you can sort on any column and use the locate command to help you find other trace logs. For example, you can sort on userid to group all your own trace logs together.

   Now, select your trace log data set for print.

   ```
   LC       (Line Command)
    P       (for PRINT)
   ```

   The Batch Trace Print panel is displayed, as shown in Figure 133, where you can specify options to print a batch report.

Printing a Trace

```
BMC Software ------------ BATCH TRACE PRINT ----------------  PERFORMANCE MGMT
COMMAND ===>                                                    TIME --- 15:00

Update job ==> N (Y/N - update job statement)                (END to edit JCL)
Title line 1 ==>
Title line 2 ==>

Data Selection:
 From date  ==> 16SEP2003  Time  ==> 1125
 To   date  ==> 17SEP2003  Time  ==> 1412

   PLAN     ==>
   AUTHID   ==>
   CONNECT  ==>
   CORR     ==>
   LOC      ==>
   DB2PKG   ==>

REPORT SELECTION:
   LTRAC ==> NO                          (YES/NO)
   STRAC ==> NO                          (NO,ALL,SUMMARY,section1,section2..)
   DTRAC ==> NO                          (YES/NO)
   POPUP ==> NO                          (NO/ALL/SQL/event1,event2,....)
   TSUM  ==>          (A/C/L/P/T)        SORT     ==>       (for any TSUMx)
   TSTAT ==> NO       (SUMMARY/ALL/NO)   INTERVAL ==> 1H    (for TSUMT only)
   DBIO  ==>          (X/A/C/F/L/P/T/xx) IOSORT   ==>       (for any DBIOx)
                                         IOINTVL  ==> 10M   (for DBIOT only)
```

Figure 133. Batch Trace Print Panel

2. If this is your first time using this option, you must update your job statements.

   ```
   Update Job ==> Y
   ```

3. Press **Enter** to display a job statement data entry panel.

   Fill in the required information and return using **PF3**.

4. Set the Update Job option to **N**.

5. Fill in the options for a report.

   ```
   TITLE1 ==> any title   Optional. Centered in first report header.
   TITLE2 ==> any title   Optional. Centered in second report header.
   ```

Data Selection is optional. The selection fields can be used to reduce the amount printed from a long trace.

```
Data Selection:

  From date  ==> ddmmmyyyy  Time  ==> hhmm
  To   date  ==> ddmmmyyyy  Time  ==> hhmm
```

The date and time fields are primed with the start and end date-time of the trace. You can modify them to select a shorter time period.

```
    PLAN     ==> plan name
    AUTHID   ==> authorization id
    CONNECT  ==> connection name
    CORR     ==> correlation id
    LOC      ==> location name
    DB2PKG   ==> db2 package name
```

The Data Selection identifiers allow you to select only a subset of threads that you need to analyze further, such as one particular plan from a Thread History (THRDHIST) trace.

```
REPORT SELECTION:
 LTRAC   ==>  N
 STRAC   ==>  ALL             Print data per thread traced.
 DTRAC   ==>  N
 POPUP   ==>  N
 TSUM    ==>
 TSTAT   ==>  N
 DBIO    ==>
```

There are many different reports that can be generated, either singly or combined. See "Batch Trace Print" on page 155 for some examples. Browse "Printing a Trace" in Volume 2 of the *MAINVIEW for DB2 User Guide* for a full explanation of the options and to see sample reports.

The reports are based on printouts of the online displays, so the options are selected using the names of these displays, like LTRAC, STRAC, DTRAC. In this tutorial we have chosen **STRAC=ALL** as the most useful report for application tuning. It shows the following for each thread traced:

- Basic **DB2 accounting record** data
- **Environmental Indicators** section
- **Elapsed Time Analysis** section
- **SQL Statement Execution Counts** section
- **Buffer Pool Usage Analysis** section, including Global Buffer Pools
- **Lock Activity** section, including Global Locks
- **I/O Parallelism** section
- **Routines** section (stored procedures and user-defined functions)
- **DDF Summary** section (if distributed work was done)
- **Package/DBRM Overview** section (if accounting trace 7 is active)

These sections are included for detail traces that captured the relevant events:

- **SQL Summary** section with summary statistics per SQL statement (SQL events)
- **Database Summary** section with scans per page set (SCAN events)
- **Database Lock and I/O** section with locks and I/O data per page set (I/O or lock events)
- **Sort Summary** section (if any sorts were performed) (any detail trace)

6. Press **Enter** to validate your specifications.

   These options are saved in your profile and used to initialize the fields the next time this panel is requested.

   Note: Be careful! Select only the data you want to print. This report is per thread execution (like an accounting trace report from DB2PM) and can generate a large amount of output.

7. Press **PF3** to review the generated JCL in edit mode.

   The options you specified are inserted into a pattern job DZJPTRAC in BBPROF. You may want to copy this JCL into your own UBBPROF profile data set and modify it.

8. Review the remaining options.

   There are many more print options than can be shown on the panel, such as lines per page or maximum pages to print. The sample job contains a short description of these options. Scroll to the bottom to review them.

9. Submit the job.

   ```
   COMMAND ===> SUB
   ```

   Of course, if you prefer, you can **SAVE** the JCL for later execution, or even **CANCEL** it completely.

10. When the job is completed, review the output.

11. Press **PF3** to return to the Batch Trace Print panel. You can issue another request now if desired.

Other Accounting Report Examples

Here are a few examples of workload-oriented reports based on the DB2 accounting record. For quick reports submitted online through the trace print panel, you will generally select one of the trace logs created by the Thread History (THRDHIST) trace for the time period you are interested in. However, these same accounting reports can be produced from any other summary or detail trace log. See "Print Offline Reports" on page 155 for more complete batch reporting options.

- For a summary of total DB2 activity for the selected time period, you can first select an overview summary by time (broken into 30 minute intervals in this example), followed by a summary of all accounting data with useful averages, totals, and maximums for the complete period.

  ```
  TSUM ==>T
  TSTAT==>SUMMARY        INTERVAL==>30M
  ```

- To change the summary to a graphic format, edit the generated selection statements in the JCL before submitting the job:

  ```
  TSUM=T,I=30M,GRAPH=TOT (or AVG)
  ```

- For a summary by plan (or other identifier), specify

  ```
  TSUM=P     (or A for authorization ID, and so on)
  ```

  All the other summarization options of AUTHID, connect, buffer pool, location, and time are also available.

- For a quick list of each thread, specify

  ```
  LTRAC==>Y
  ```

- To generate a report of activity in each individual buffer pool per thread, specify

  ```
  STRAC==>BPOOL
  ```

  For a summary of this information per individual buffer pool for all selected threads, look at this same section in the TSTAT SUMMARY report mentioned above.

Other Detail Trace Report Examples

You may want to try other report combinations too. Here are a few examples from detail traces:

- For an SQL statement summary per thread, sorted by Average CPU usage, followed by average SQL row processing statistics per statement:

```
LTRAC  ==>  Y
STRAC  ==>  SQL,SORTSQL=AC,SQLPOPUP
```

- For a detail event trace per thread, with pop-up displays per SQL statement:

```
LTRAC  ==>  Y
DTRAC  ==>  Y
POPUP  ==>  SQL
```

- For SQL statement text and EXPLAIN data for all dynamic SQL executed or BINDs of static SQL:

```
POPUP ==> (BIND-TEXT,EXPLAIN)
```

- For a summary of I/O counts and wait times per database, table space, and plan (from an I/O trace):

```
DBIO ==> XP
```

- To summarize by plan, database, and table space:

```
DBIO ==> PX
```

You can adjust many formatting options:

NEWPAGE Control page breaks

WIDTH Specify wide (133) or narrow (81) output

LINECNT Adjust the number of lines printed per page

HEADING Suppress headings

MAXPAGES Limit the amount of output to prevent an unexpectedly high print volume

Online Views

You can export any windows-mode view to a data set or print it to a SYSOUT class using the **EXPort** command. The exported view can be used to supplement performance reports or can be downloaded to a workstation for use with a spreadsheet application.

When you enter the **EXPort** command, a panel is displayed requesting an existing data set name (or SYSOUT class) and formatting options, as shown in Figure 134.

Export a View for Printing

```
----------------------------- Export Open Data Set ----------------------------
COMMAND ===>


LIBRARY (PDS):
   Project        ===>
   Group          ===>
   Type           ===>
   Member         ===>           Replace (Y/N)? YES

Other partitioned or sequential data set:
   Data Set Name  ===>
   Volume serial  ===>         If not cataloged

Export Options:
   Disposition    ===> REPLACE Replace or Append if sequential data set
   Output format  ===> ASIS    ASIS or CSV
   Lines/Page     ===> 0       ASIS format only (NNN)
   Sysout Class   ===>         If specified, overrides other data set options

Press END to save changes and export report.
Type CANCEL to return to previous panel without saving changes.
```

Figure 134. View Export Panel

The output of the **EXPort** command includes all the rows of data associated with the view, even data that requires scrolling to be seen online. However, if the logical record length (LRECL) of the data set is less than the width of the view, the view data is truncated on the right.

Print Offline Reports

You can print

- Offline traces from a trace log data set or SMF records
- Offline Performance Reporter reports from both SMF data and DB2 tables

Batch Trace Print

Most scheduled batch reporting is done with the Performance Reporter reports either directly from SMF data or from that same data loaded (often summarized) in DB2 tables. However, this data is often not available to answer questions about the DB2 workload until the next day. The batch trace print facility is designed to fill the need for quick reports. All the trace summary accounting report formats are available, in any combination.

There are different types of input:

- One or more trace log data sets

  For example, the Thread History trace.
- The archived trace logs (without reloading to VSAM)

  For example, thread history from two weeks ago.
- An SMF history file containing DB2 Accounting records or I/O trace IFCIDs
- The live SMF data sets
- A GTF trace data set

A batch utility job, DZTBTRAC, is provided in your BBSAMP data set to print these reports. There is also a sample JCL member DZTBPRNT you can use when you want to generate multiple reports or print accounting reports from SMF data. The control statements for several sample reports are provided in BBSAMP member DZJPnnnn, with comments to point out some of the most useful variations.

The trace data shown in the batch reports is in the same format and content as the online displays. This includes LTRAC, STRAC, DTRAC, DTRAC pop-ups, TSTAT, and the TSUMx and DBIOx series of displays. Many of these displays can also be combined into one report. For example, a report can consist of both LTRAC and DTRAC data. Selection options, such as plan, authorization ID, or date can be used to narrow the scope of a report. In addition, you can focus in on just one area of interest, such as buffer pool activity by individual pool.

All of the report options described in “Print Online Reports” on page 148 are also available by directly editing and submitting the batch trace print job, first specifying the input file and the reports to be printed.

Trace Print from a TLDS

To print a trace log data set, use the JCL provided in BBSAMP members DZTBTRAC, as shown in Figure 135. Specify the DSN of the log with the TLDS parameter. Multiple TLDSs can be concatenated.

Specify JCL Statements

```
//         JOB (ACCT),'NAME'
//DZTBPRNT PROC TLDS=NULLFILE,            INPUT TRACE DATA SET
//             TDIR=NULLFILE,             INPUT TRACE DIRECTORY
//             SMF=NULLFILE,              INPUT UNLOADED SMF FILE
//             GTF=NULLFILE,              INPUT GTF FILE
//             ARC=NULLFILE,              INPUT ARCHIVED TRACE DATA SET
//             PFX='HILVL.RUN.LIB'        DSN PREFIX OF BBLINK
//PRINT   EXEC PGM=DZTBPRNT,REGION=4M,PARM='GMWK=128K'
//*                                      INCREASE GMWK FOR LARGE TRACES
//STEPLIB   DD DISP=SHR,DSN=&PFX..BBLINK
//SYSPRINT  DD SYSOUT=*                  INPUT LIST AND DIAGNOSTICS
//SYSUDUMP  DD SYSOUT=*                  ABEND DUMPS
//STD1      DD SYSOUT=*                  DEFAULT REPORT OUTPUT
//*
//*    ===>    ONLY ONE OF THE FOLLOWING INPUT DD'S MAY BE SPECIFIED
//*    ===>    IF NONE IS SPECIFIED, DEFAULT INPUT IS LIVE SMF DATASET
//*
//TRACIN01  DD DISP=SHR,DSN=&TLDS        TLDS INPUT
//TRACEDIR  DD DISP=SHR,DSN=&TDIR        TLDS INPUT THRU TRACE DIR
//SMFIN     DD DISP=SHR,DSN=&SMF         SMF INPUT
//GTFIN     DD DISP=SHR,DSN=&GTF         GTF INPUT
//ARCIN     DD DISP=SHR,DSN=&ARC         ARCHIVED TLDS INPUT
//        PEND
//*
//*                     ** SPECIFY INPUT FILE **
//PRINT   EXEC DZTBPRNT,TLDS='SYS5.DB2P.THRDHIST.JUL01.T0001.V01'
//REPTDD1   DD SYSOUT=*                  USER-DEFINED OUTPUT DD
//RPTSUM    DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTWKLD   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTACCL   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTACCS   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTSQL    DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTEVNT   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTEXPL   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTFAIL   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTDBIO   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//*SYSIN    DD *                         FOR IN-STREAM REPORT STMTS
//SYSIN     DD DSN=&PFX.BBSAMP(DZJPSUM)   DEFAULT SUMMARY RPT  (SUM)
//          DD DSN=&PFX.BBSAMP(DZJPWKLD)  WORKLOAD SUMMARY-TIME(SUM)
//*         DD DSN=&PFX.BBSAMP(DZJPACCL)  ACCTG DETAIL-LONG    (SUM)
//*         DD DSN=&PFX.BBSAMP(DZJPACCS)  ACCTG DETAIL-SHORT   (SUM)
//*         DD DSN=&PFX.BBSAMP(DZJPSQL)   SQL STATEMENT SUMMARY(D-SQL)
//*         DD DSN=&PFX.BBSAMP(DZJPEVNT)  THREAD DETAIL EVENTS (D-ANY)
//*         DD DSN=&PFX.BBSAMP(DZJPEXPL)  SQL TEXT/EXPLAIN     (D-SQL)
//*         DD DSN=&PFX.BBSAMP(DZJPFAIL)  LOCK/EDM FAILURES    (D-BASE)
//*         DD DSN=&PFX.BBSAMP(DZJPDBIO)  I/O SUMMARY BY DB/TS (D-I/O)
//*
```

Figure 135. JCL to Print a Trace (DZTBTRAC)

For detailed information about all the control statements in DZTBTRAC, see "Printing a Trace" in Volume 2 of the *MAINVIEW for DB2 User Guide*.

An example of the Accounting Summary Report produced when you submit this JCL is shown in Figure 136. It shows accounting totals, followed by a trace summary by plan.

```
BMC SOFTWARE               ACCOUNTING SUMMARY REPORT                PAGE:       2
REPORT:SUM                                                          DATE: 17SEP02
                                                                    TIME:12:16:56
- - - - - - - - - - SUMMARY STATISTICS - ALL TRACE ENTRIES- - - - - - - - - - -
-----TERMINATIONS ----------    ---------ACTIVITY-----------------------------
FIRST END..01SEP 14.37.35.21                TOTAL   AVERAGE   MAXIMUM   MINIMUM
LAST END...01SEP 14.38.45.37              --------  --------  --------  --------
NUMBER TRANS.............4    ELAPSED  00:10:20  00:02:35  00:09:12  9,695 ms
                              ELP-DB2  00:08:42  00:02:10  00:07:35  9,694 ms
NORMAL TERM..............3    CPU         21 s   5,302 ms     20 s     183 ms
-- NEW USER..............0    CPU-DB2     13 s   3,206 ms     12 s     122 ms
-- DEALLOC...............3    WAITS    00:06:53  00:01:43  00:06:11  7,678 ms
-- APPL END..............0    SQL         4,958     1,239     4,954         4
-- RESIGNON..............0    GETPAGES   27,541     6,885    27,203        56
-- DBAT INACT............0    SYNC RDS      110        27        57         0
-- IFI READ..............0    PFCH PGS   26,916     6,729    26,916         0
ABNORMAL TERM............1    UPD/COMT        0         0         0         0
IN DOUBT TERM............0    BFR HIT RATIOS:.....VP=  2%,HP=100%
- - - - - - KEY INDICATORS - - - - - - - - - - - - - - - - - - - - - - - - - -
TOTAL DDL =      4
SQL: SELECT=     0, FETCH= 4,952
SQL: DYNAMIC(PREPARE)=     1
I/O RSP: SYNC=    62 ms, ASYNC=   133 ms
LOCK SUSPENSIONS =      2

- - - - - - - - - ELAPSED TIME ANALYSIS (ACCTG CLASSES 2,3 ONLY) - - - - - - - - -

CATEGORY           #EVENTS AVG/EVENT  ELAPSED  %TOTAL
---------------    ------- --------- -------- ------- 0 ...25...50...75..100%
ELAPSED TIME                                          |                        |
  IN DB2                             7,554 ms   59.01 | ***********            |
  IN APPLICATION                     5,246 ms   40.98 | ********               |
 --TOTALS--                             13 s   100.00 | ********************   |
WAITS IN DB2 (LOCAL)                                  |                        |
  LOCK/LATCH             7    100 ms   703 ms    5.49 | *                      |
  I/O WAIT             320     12 ms 3,927 ms   30.67 | ******                 |
  LOG WRITE I/O          5  4,083 us    20 ms    0.15 | <                      |
  OTHER READ I/O         4     40 ms   159 ms    1.24 | <                      |
  OTHER WRITE I/O        0      0 us     0 us    0.00 |                        |
  UNIT SWITCH EVENTS                                  |                        |
  ..COMMIT/ROLLBK        4     16 ms    63 ms    0.49 | <                      |
  ..OPEN/CLOSE           8    159 ms 1,269 ms    9.91 | *                      |
  ..SYSLGRNG            16     13 ms   208 ms    1.62 | <                      |
  ..DATASPACE MGR        2     27 ms    53 ms    0.41 | <                      |
  ..OTHER                7  7,638 us    53 ms    0.41 | <                      |
  ARCH. LOG(QIS)         0      0 us     0 us    0.00 |                        |
  ARCH.READ(TAPE)        0      0 us     0 us    0.00 |                        |
  DRAIN LOCK             0      0 us     0 us    0.00 |                        |
  CLAIM RELEASE          0      0 us     0 us    0.00 |                        |
  PAGELATCH CONT.        0      0 us     0 us    0.00 |                        |
  SPAS SERVER TCB        0      0 us     0 us    0.00 |                        |
  Force-at-commit        0      0 us     0 us    0.00 |                        |
WAITS IN DB2 (GLOBAL)                                 |                        |
  LOCKS                 15  2,903 us    44 ms    0.34 | <                      |
  MSG. PROCESSING        0      0 us     0 us    0.00 |                        |
---TOTAL WAITS---      383     17 ms 6,480 ms   50.62 | **********             |
*NOT ACCOUNTED                          289 us    0.00 |                        |
...........

- - - - - - - - - - - - - - BUFFER POOL ACTIVITY - - - - - - - - - - - - - - -
ACTIVITY                TOTAL       BP1       BP2       BP5       BP6      BP10
------------------  --------  --------  --------  --------  --------  --------
GETPAGES...........     2,545        14       592         1         6        38
SYNC READS.........       320        11         0         0         0         0
GETPAGES/READIO....       8.0       1.3       0.0       0.0       0.0       0.0
COND. GP FAILURES..         0         0         0         0         0         0

SEQ. PREFETCH REQS.        22         2         0         0         0         6
LIST PREFETCH REQS.         1         0         0         0         0         0
DYNAMIC PREFETCHES.        16         1         0         0         0         0
ASYNC PAGES READ...       284        47         0         0         0         0
PAGES/PREFETCH REQ.       7.3      15.7       0.0       0.0       0.0       0.0
...........

BMC SOFTWARE               ACCOUNTING SUMMARY REPORT                PAGE:       4
REPORT:SUM                                                          DATE: 17SEP02
                                                                    TIME:12:16:56
                           I/O SYSTEM TRACE
          ENTRY    AVG      AVG     AVG    AVG    TOTAL    TOTAL   TOTAL  TOTAL
PLAN      COUNT  ELAPSED    CPU   #STMTS GETPGS  ELAPSED    CPU   #STMTS GETPGS
-------- ------ -------- -------- ------ ------ -------- -------- ------ ------
DSNTIA41     11   483 ms   172 ms   11.3  162.3 5,309 ms 1,889 ms    124  1,785
DSNTIB41      1    18 s  5,954 ms    1.0   20.0    18 s  5,954 ms      1     20
DSN8CC0       2 00:01:07    19 ms   12.0    7.0 00:02:13    38 ms     24     14
RXDB2         1 6,086 ms 2,633 ms  245.0  1,160 6,086 ms 2,633 ms    245  1,160
************************** END OF SUMMARY ENTRIES **************************
```

Figure 136. Accounting Summary Report

All control of the input and formatting is done through a series of keywords in the input job stream (or in a PDS member) under ddname SYSIN. Keywords that apply to all requested reports can be specified following a label of GLOBAL. Keywords that apply to a specific report must be specified following the REPORT label. An example of two report requests is shown in Figure 137.

Specify Request Keywords

```
GLOBAL  TIME=1300-1500
*
*       BIND-TEXT and EXPLAIN FROM TSO
*
REPORT  REPORTID=DAILY1,LTRAC=YES,NEWPAGE=TRAN,
        POPUP=(BIND-TEXT,EXPLAIN,OPEN),
        CONNECT=TSO,
        TITLE1='DETAILS OF BIND AND EXPLAIN',
        TITLE2='WITH STATS FROM OPEN',
        DDN=OUTPUT1,WIDTH=WIDE       COMMENTS ABOUT THE REPORT
*
*       FULL EXAMINATION OF CERTAIN SPECIAL TRANSACTIONS
*
REPORT  REPORTID=SPECIALS,LTRAC=YES,STRAC=SUMMARY,DTRAC=YES,POPUP=ALL,
        NEWPAGE=(TRAN,FIRSTEVENT),LEVEL=3,
        PLAN=(PAY+++++,ACCT1+++),CONNECT=IMSP,
        AUTHID=(USR1,USR5)
```

Figure 137. Sample Report Requests

The GLOBAL keyword TIME limits the trace output to 1pm to 3pm for both reports.

The first report prints the one-line LTRAC entry on a new page for each transaction of the selected TSO threads and the pop-ups for BIND-TEXT, EXPLAIN, and OPEN after that one-line entry for each transaction. The report is written on ddname OUTPUT1.

The second report prints the one-line LTRAC entry, the STRAC accounting summary, and all DTRAC events and pop-ups for selected plans from two specific IMS users. The report is written on ddname SPECIALS.

For detailed information about each of the request keywords you can use, see "Printing a Trace" in Volume 2 of the *MAINVIEW for DB2 User Guide*.

Trace Print from SMF Records

This same batch utility (DZTBTRAC), shown in Figure 135 on page 156, can be used to print summary trace reports from DB2 accounting records written to GTF or SMF, either from an SMF history tape or from the live SMF data sets.

In addition, the following I/O analysis reports can be produced from an SMF or GTF file that includes the I/O trace records (IFCIDs 06-10):

DBIO=X
: I/O analysis by database and table space

  Note: This report can be summarized by many different summary key combinations, such as plan, database, table space or database, table space, plan. See “Special Report Summarization Options for DBIO” in Volume 2 of the *MAINVIEW for DB2 User Guide* for examples.

DBIO=A
: I/O analysis by AUTHID

DBIO=C
: I/O analysis by connection name

DBIO=F
: I/O analysis by buffer pool

DBIO=L
: I/O analysis by location

DBIO=P
: I/O analysis by plan

DBIO=T
: I/O analysis by time interval

Note: Other detail trace events are not extracted from SMF or GTF. In addition, you cannot process SMF or GTF files in the same run with TLDSs.

Performance Reporter Reports

Performance Reporter is an offline analysis system that produces reports that can be used to evaluate DB2 system and application performance. These evaluations can be used for DB2 planning, forecasting, and performance management.

Several reports can be produced from Data Collector archive data sets or SMF extract files without loading the data into DB2 tables. For longer term storage and trend reporting, summarized data can be loaded to the performance data tables.

Also, the accounting data supports several levels of summarization. You can print any number of reports produced from the summary and detailed accounting tables, or statistics, buffer statistics per pool, and audit tables. Additional reports are available from the Data Collector, such as a storage report from IFCID 225.

When you want reports produced directly from the input data, and only the reports are needed, it is recommended that you use the Data Collector reports. If you are also loading data into tables, consider the Reports from SMF so that you extract the data only once.

Data Collector Reports

These reports can cover one day, several days, or just a short recent interval, depending on the number of archive files used as input. For immediate reporting, you can produce reports from the active Data Collector trace data sets.

You can review the available archive trace data sets from the Data Collector Administration panel (hyperlink from EZDB2), option D, Archive Directory.

Reports on accounting, statistics and audit data are available, as well as a DBM1 storage usage report (IFCID 225) and utility processing (IFCIDs 23-25).

Reports from SMF

Selective or total accounting reports, in either a short or a long format, can be printed from DB2 accounting records extracted from one or more SMF files. For example, you can select from a specific time period or by plan, authorization ID, and so on. The reports also can be summarized by various criteria.

Use the DPREPORT batch job to print accounting or statistics reports, in either a short or a long format. Figure 138 on page 161 shows sample job control statements for producing an accounting long report ordered by primary authorization ID and plan name, summarized in 8-hour intervals.

Specify Job Control Statements

```
//DPRACCT JOB
//*-------------------------------------------------------------
//*         JOB TO PRODUCE AN ACCOUNTING LONG REPORT            -
//*         ORDERED BY PRIMARY AUTHID AND PLAN NAME             -
//*         FROM 00:00:00 - 23:59:59 HOURS FOR OCT. 16 - 18,    -
//*         SUMMARIZED IN INTERVALS OF 8 HOURS (480 MINUTES).   -
//*         ONLY AUTHIDS OF BPL2X OR THOSE BEGINNING WITH CJN*  -
//*         ARE SELECTED FOR THIS REPORT.                       -
//*-------------------------------------------------------------
//STEP1    EXEC PGM=DPREPORT,REGION=4096K
//STEPLIB  DD   DSN=HILVL.DPRLOAD,DISP=SHR
//DPDACCT  DD   DSN=HILVL.ACCT31,DISP=SHR
//SYSPRINT DD   SYSOUT=*
//DPDPRINT DD   SYSOUT=*
//SYSOUT   DD   SYSOUT=*
//SYSUDUMP DD   SYSOUT=*
//SORTWK01 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK02 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK03 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK04 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK05 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK06 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK07 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK08 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SYSIN    DD   *
REPORT=ACCT
REPTYP=LONG
RSMFID=SYSB
RDB2ID=DB2F
FRDATE=20020516
FRTIME=000000
TODATE=20020518
TOTIME=240000
INTVAL=480
RORDER=(PRAUTH,PLANAM)
FILTYP=(PRAUTH)
FILTR1=(BPL2X,CJN*)
//
```

Figure 138. Sample DPREPORT Job Control Statements for Accounting Reports

See “SMF Reporting Facilities (DPREPORT)” in the *MAINVIEW for DB2 Performance Reporter User Guide* for detailed information about each of the JCL control statements in the DPREPORT job.

Reports from DB2 Tables

Printing workload reports is usually done from the DB2 tables of performance data supported by Performance Reporter. This gives you long-term history and trending, as well as the full flexibility of SQL for defining your own reports in addition to the predefined set. See “Reports from DB2 Tables” in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

Performance Reporter provides predefined reports using SQL statements, which can be run through a batch reporting facility (DPRREPT) or through QMF queries. DB2 performance charts and plots are also provided, which are available through QMF only. Other queries and reports based on the performance data tables can also be defined.

Predefined Reports

The prepared reports included with Performance Reporter show DB2 system workload to help the DB2 performance analyst, capacity planner, or service manager solve specific DB2 problems. These reports are generated from accounting, statistics, and audit data.

With these reports, standard reporting can be run on a daily or weekly basis or both.

Daily run

The queries processed by the batch reporting program, DPRREPT, from the detail statistics (queries STxxx) and detail accounting (queries ACxxxx) tables are set up to produce a set of daily reports on the data loaded from the previous day (current date minus one). The sample JCL in BBSAMP named DPRRPT includes all distributed reports. Run these reports once, select those ACxxxx and STxxx reports you want to review daily, and create a job for this daily run.

Note: Generally, you will not want to load detail accounting records into table DMRACDTL, but only data summarized by hour or day into table DMRACSUM. In this case, delete the ACxxxx reports from the job and modify the date selection on the SAxxxx reports to produce your daily reports. The report results will be the same. Only the detailed exceptions report cannot be produced.

Weekly run

The queries processed by the batch reporting program, DPRREPT, from the summary accounting table (queries SAxxxx) are set up to produce a set of weekly reports on the data from the previous week (current date to current date minus seven). Select the SAxxx reports you want to review weekly and create a job for this weekly run.

Note: You can also summarize the daily table to other tables at a higher level, such as weekly or monthly. The SA*xxx* reports can also be used with these tables.

Any of the distributed SQL queries can be modified or used as a model to produce queries to satisfy ad hoc reporting needs. However, the flexibility of QMF, in general, makes it the better vehicle for such reporting. An added advantage with QMF is that the procs provide an easy way to select a specific time period for reporting without modifying the queries themselves.

QMF Queries

QMF can be used to run distributed reports or tailor custom performance reports and charts. A generalized QMF procedure, DZPRQRPT, runs predefined Performance Reporter queries and formats the reports using the distributed Performance Reporter forms. The predefined reports produced with QMF are the same as those produced with the batch reporting facility, DPRREPT. However, with QMF, you can select a range of dates for these reports.

Note: You must enter the QMF program to use this procedure. Detailed instructions to run and use QMF can be found in the *IBM Query Management Facility Learner's Guide*.

To run the predefined Performance Reporter queries from QMF, type the command:

```
RUN DMRPR.DZPRQRPT (&REPORT=report name
```

where `report name` is the name of the report you want to produce. For example, to run the DB2 Accounting Overview Report, type

```
RUN DMRPR.DZPRQRPT (&REPORT=ACOVERA
```

The report table date range prompts FROM and TO might appear when running these queries under QMF. Type the date range you want using the standard TSI format:

```
'YYYY-MM-DD-HH.MM.SS.TTTTTT'
```

Or, you can set global report variables by typing one of these procs:

```
RUN DMRPR.DZPRQDAT
```

```
RUN DMRPR.DZPRQDEF
```

Once you have set these global variables, they will be used by all Performance Reporter report queries for the duration of the QMF session.

To produce QMF batch reports, use the sample jobs in BBSAMP member DZPRQBAT.

Customizing Your Own Reports

Once you have used the Performance Reporter facilities to load data into DB2 tables, you may want to use your own reporting tools to create customized reports.

However, since Performance Reporter uses either QMF or a generalized report generator to provide reporting and charting facilities, the entire report is defined by the SQL select statement used to read the data tables. Thus, it is very easy to create customized reports for a specific requirement. The SQL select statements used to produce the distributed reports and charts are available, within the QMF or DPRREPT environments, as models in tailoring new reports or charts.

The JXREPT program is designed to run any SQL SELECT statement against the Performance Reporter tables and report the results.

See “Customizing Reports” in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

One example of a custom report you may want to create is to change the time interval for reporting statistics data.

The default statistics reports show statistics by the DATETIME stamp in each record. To provide a historical view, you may want to modify the distributed reports to show statistics grouped by a longer time interval. To simplify this type of reporting, the statistics tables include columns for several other date and time values, such as DATE, MONTH, DAY, TIME, and HOUR.

Note: Data is not *spread* across intervals.

An example of a report by DATE and HOUR is in BBPARM member STOVERH, as shown in Figure 139. See “Reporting Statistics Data by Time Interval” in the *MAINVIEW for DB2 Performance Reporter User Guide*.

```
BMC SOFTWARE                          DB2 STATISTICS OVERVIEW REPORT - AVERAGES                          PAGE 0002
REPORT: STOVERH                                                                  REPORT DATE: 2002-09-25 11.14.54
DATE FROM: 2002-09-01 00:09:01                                                          LOCATION - SANJOSE
DATE TO:   2002-09-19 23:55:49                                                           SUBSYSTEM - DB2P

                CREATE PHASE 2   SYNC           SQL     SQL     SQL   GETPAGES PAGE     READ   WRITE    EDM LOG WRT    LOCK
DATE / HOUR     THREADS COMMITS COMMITS  ABORTS  MANIP. CONTROL DEFINIT   REQS  UPDATES   I/O     I/O    LOADS   CALLS  SUSPEND
--------------- ------- ------- -------- ------- ------- ------- ------- ------- ------- ------ -------- ------- ------- -------
2002-09-01 00         1     0.0      0.0     0.0     0.0     0.0     0.0     6.0     0.0    1.0      0.0     0.0     0.0     0.0
2002-09-01 01         0     0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0    0.0      0.0     0.0     0.0     0.0
2002-09-01 02         8     0.6      0.5     0.1     1.2     2.2     0.0   367.7   176.7   15.7      1.3     1.3     4.0     0.0
2002-09-01 03         3     0.3      1.0     0.0     0.6     0.0     0.0    64.6    30.6    1.6      4.0     0.0     2.0     0.0
2002-09-01 04         1     0.0      1.0     0.0   253.0     0.0     0.0   520.0     0.0   15.0      0.0     2.0     0.0     0.0
2002-09-01 05         1     2.0      0.0     0.0     1.0     0.0     0.0    10.0     0.0    8.0      0.0     0.0     0.0     0.0
2002-09-01 06        14     1.0      0.0     0.0     1.0     0.8     0.0    17.3     0.0    4.8      0.0     0.2     0.0     0.0
2002-09-01 07        10     0.6      0.7     0.0     1.4     1.5     0.0   304.6   168.1    4.7      2.4     0.0     3.4     0.0
```

Figure 139. Statistics Overview Report by DATE and HOUR

Index

Symbols

prefix
  definition 32
#SQLM monitor
  tutorial example 32
* (asterisk)
  wild card
    tutorial example 110
+ (plus)
  qualifier
    tutorial example 110
@ prefix
  definition 32

A

accessing
  MAINVIEW 6
  thread history data 100
accounting records
  tutorial example
    LTRAC display 77
    STRAC display 78, 109
    TSTAT display 91
active requests
  list of monitors 31, 37
active threads
  all 12
  multiple DB2s 14
Active Timer Request list
  tutorial example 31, 37
    select by area 38
Activity Overview view 10, 16
Activity Rates view 10
Add SSI Context Definition panel 49
All Active Threads view 12
analyzer
  tutorial example
    Primary Option Menu selection 8
application I/O analysis
  tutorial example
    activity by package/program 92
    activity by page set 92, 117
    activity by plan 92, 118
    activity by SQL statement 93
    asynchronous I/Os 92, 117
    collecting I/O events 116
    detail I/O events 93, 116
    printing I/O reports 119
    running a system I/O trace 116
    summarized trace events 92, 93, 117
    synchronous I/Os 92, 117
    system-wide traces 115
    total measurements 117
application trace
  tutorial example
    access services 76
    accessing EXPLAIN 136
    activating 72
    additional options 68
    analyzing DB2 workload 99
    avoiding expensive lock event traces 87
    BIND-TEXT pop-up 130
    buffer pool activity 80
    collecting I/O events 116
    database summary 85
    defaults 67
    detail entry display (DTRAC) 89, 130, 139
    detail event summaries 82
    detail events 70, 116
    elapsed time 79
    error messages 72
    exception filters 69
    EXPLAIN pop-up 131
    I/O analysis 92, 115
    improve performance 73, 124
    list of current 66, 75
    list of historical data sets 75, 94, 148
    list of trace entries (LTRAC) 77
    lock and I/O events 86
    LOCK-SUMMARY pop-up 131
    logging 71
    long-running threads 75
    managing log data sets 94, 148
    narrowing 69
    navigating 76, 88
    package/DBRM overview 81
    printing 94, 119, 148
    qualifying 68
    sort summary 87
    SQL statement pop-up 84, 90, 138
    SQL statement summary 82, 88, 137
    starting 66, 116, 125
    summary by authorization ID 110
    summary by connection name 110
    summary by DDF location 110
    summary by relative day 110
    summary entry display (STRAC) 78, 109
    summary of all threads (TSTAT) 91, 110
    test applications 73, 124
    tuning 65, 75
application transfer
  tutorial examples 33, 35
    CT command 125
    LOG command 43, 110
    SM command 31
    ST command 66, 125
    to full-screen mode 18
application tuning
  with trace
    tutorial example 65, 75

AREA command
tutorial example 32, 38
asterisk (*)
qualifier
tutorial example 110
ASYNC parameter
tutorial example 92
ATTN key
terminating GO
tutorial example 39
audit trail 43
authorization
for tutorial exercises
cancel a thread 13
issue DB2 commands 45
issue RESET USERID command 65
modify or purge a monitor 34
start an application trace 65, 66, 115
update BBPARM data set 65
automatic multiple requests startup 31, 37
automatic refresh mode
monitor history display
tutorial example 39
automatic warning 31, 33, 37
AutoOPERATOR
triggering EXECs 33
average data measurement 32

B

balancing
table space allocations
tutorial example 30
batch trace print
tutorial example 94, 119, 148, 155
data entry panel 95, 120, 149
SQL prototype 132
BFRPL view
tutorial example 20
BFRPLD view
tutorial example 20
BFRPLHD view
tutorial example 21
bind
text pop-up
tutorial example 90, 130
BLKDMRW
default set of monitors 31
blocking requests
automatic start 31
buffer pool
tutorial example
activity summary (STRAC) 80
all defined pools 20
hit ratios 21
one pool 20
tune for data sharing group 61
Buffer Pool Page Set GBP-DEP Summary view 55
Buffer Pool Page Set Summary - Session view 30
Buffer Pool Rates Detail view 21
Buffer Pool Statistics - SSI view 20

C

cache
statistics
tutorial example 29
cancel thread
from DUSER display 13
card
quick reference 1
catalog access 22
CATALOG hyperlink 140, 141
CATALOG MANAGER Browse 22
check status and activity 8, 16
codes
severity 36
commands
application transfer
tutorial examples 31, 33, 35
windows to full-screen mode 18
DB2
displaying response 45
issuing from MAINVIEW for DB2 45
view all 46
COMMIT
execute SQL 126, 138
compare threads 88
CONACT view
tutorial example 48, 51, 52
CONASEL view
tutorial example 48
console
MVS
warning messages sent to 33
contention
lock
tutorial example 23, 37
with data sharing 57
context
defining
for a data sharing group 48
selecting 48
CONTEXT command
tutorial example 15, 48
count data measurement 32
critical problems
review
tutorial example 35
CT application transfer
tutorial example 125
current
hit ratios 21
SQL statement
full text 13, 134
SQLID 127, 134, 138
thread activity 12
multiple DB2s 14
Current Traces application
tutorial example 66, 75

D

Data Collection Monitor list application
  tutorial example
    scroll 32
    select by area 32, 38
    sort 32
Data Collector
  reports 160
  workload analysis from active trace data sets 112
data selection identifiers
  tutorial example 150
data sets
  tutorial examples
    I/O analysis 140
data sharing
  buffer pool tuning 61
  current group activity 51
  defining the group context 48
  lock contention 57
  monitoring a group 47
  page set considerations 53
Data Sharing Wizard GBP Directory Detail view 63
Data Sharing Wizard GBP Directory Entries view 63
Data Sharing Wizard GBP Options view 62
Data Sharing Wizard GBP Size Activity view 64
Data Sharing Wizard GBP-DEP/Member view 54
Data Sharing Wizard Group Members view 61
DB2
  accounting record
    LTRAC display 77
    STRAC display 78, 109
  commands
    displaying response 45
    issue from MAINVIEW for DB2 45
    view all 46
  Exceptions display
    tutorial example 36
  messages
    logging 43
    selecting current target DB2 44
    viewing a subset 44
  Performance Management
    isolating problems 5, 109
  status 8, 16
    detail view 16
  topic index access 19
DB2AUTH keyword
  tutorial example 68, 116
DB2CONN keyword
  tutorial example 33
DB2EX display
  tutorial example 36
DB2PLAN keyword
  tutorial example 68
DB2TRACE authorization parameter
  for tutorial exercises 65
DBIO display
  tutorial example 92, 117
DBIOD display
  tutorial example 140
DBIOP display
  tutorial example 118
DBIOS display
  tutorial example 93
DBRM
  overview (STRAC)
    tutorial example 81
defaults
  for starting a monitor 32
  for starting a trace 67
  query number 128
  starter set of monitors 31
definitions
  all SSI contexts 48
detail trace
  tutorial example
    avoiding expensive lock event traces 87
    BIND-TEXT pop-up 130
    database summary 85
    detail entry display (DTRAC) 89, 139
    display level 89
    event summaries (STRAC) 82
    EXPLAIN pop-up 131
    I/O analysis 93, 117, 118
    lock and I/O events 86
    LOCK-SUMMARY pop-up 131
    navigating 88
    sort summary 87
    SQL statement pop-up 84, 90, 138
    SQL statement summary 82, 88, 137
    starting 70, 116
    testing SQL 130
detail user display
  tutorial example 12, 134
directory
  tutorial example
    too few entries 62
DMAREAZ view
  tutorial example 41
DMRBEX00
  logging DB2 messages
    tutorial example 43
DMWARN view
  tutorial example 40
DOBJ view
  tutorial example 42
DTRAC
  display
    avoiding expensive lock event traces 87
    BIND-TEXT pop-up 130
    EXPLAIN pop-up 131
    LOCK-SUMMARY pop-up 131
    SQL statement pop-up 90
    testing SQL 130
    tutorial example 89, 139
DUSER display
  tutorial example 12, 134
DZJPTRAC skeleton JCL member
  tutorial example
    printing a trace 96, 121, 151
DZTBPRNT program 120, 155
DZTBTRAC utility 155

E

Easy Menus
  EZDB2 (one DB2)
    tutorial example 15
  EZDEVENT (system events) 46
  EZDSSI (multiple DB2s)
    tutorial example 9, 40
elapsed time analysis
  tutorial example 79
Enhanced Journal Facility 44
error messages
  current traces
    tutorial example 72
event pop-up displays
  tutorial example
    BIND-TEXT 90, 130
    EXPLAIN 90, 131
    LOCK-SUMMARY 90, 131
    LOCK-TMO 90
    MULTI-INDEX 90
    SQL statement 90, 131
events menu 46
exception
  conditions
    system 14
    user 14
    warning monitors 14
  locate time
    tutorial example 43
Exception Conditions view 14
Exception Filters
  tutorial example 69
exception messages
  displaying 36
EXEC
  application transfer command
    tutorial example 35
  triggered when threshold is exceeded 33
execute SQL
  tutorial example 126
    from a trace 138
    results of execution 127
expand
  tutorial examples
    BIND-TEXT pop-up 130
    from DBIOD display 140
    from DBIOR display 140, 141
    from DTRAC display 130, 131
    from DUSER display 134, 135
    from LTRAC display 77, 91, 92
    from SQL statement pop-up 84, 138
    from TSTAT display 92
    from USERS display 134
    to buffer pool activity 80
expand *(continued)*
  tutorial examples *(continued)*
    to database summary 85
    to DB2 catalog information 140
    to DBIO display 92, 117, 118
    to DBIOD display 140
    to DBIOP display 118
    to DBIOS display 93
    to detail entry display (DTRAC) 89, 139
    to DTRAC display 130
    to DUSER display 134
    to elapsed time analysis 79
    to EXPLAIN PLAN_TABLE display 134, 135
    to EXPLAIN pop-up 131
    to lock and I/O events 86
    to LOCK-SUMMARY pop-up 131
    to package details 81
    to sort summary 87
    to SQL statement pop-up 84, 90, 138
    to SQL statement summary 82, 88, 137
    to SQL statement text 84, 138
    to STRAC display 77, 109
    to TSTAT display 91, 110
EXPLAIN from edit 128
EXPLAIN hyperlink
  from a trace
    tutorial example 136
EXPLAIN PLAN_TABLE
  output panel 129, 135
  qualifier panel 128, 134
  tutorial example
    accessing from a trace 138
    accessing more details 144
    information for one plan 144
EXPLAIN pop-up
  tutorial example 90, 131
EXPort command 154

F

Fast Menu 18
fetches
  execute SQL
    tutorial example 126, 138
filtering data
  tutorial examples 28
filters
  local 114
  tutorial example 69
FIND command
  tutorial example 43
format
  options
    batch trace print 97, 153

G

global
  lock contention 57
Global Lock Wizard view 57
Global Lockout Events view 59
GO command
  tutorial example 39
goals
  response time
    monitoring 42
graph
  tutorial example
    CPU time 78
    elapsed time 78, 79
    I/O wait time 92, 93
    monitor history display 38, 41
    package/DBRM overview 81
    total values 106
    warning status of active timer requests 31, 37
    workload objectives 42
group buffer pool
  dependent page sets 54
  tuning 61
GROUPSQL keyword
  tutorial example 70

H

headers
  suppress 153
help
  commands 28
  tutorial example 34, 55
history
  accessing data 100
  data collection 100
  reviewing recent
    tutorial example 16
  short-term 31
  trace directory
    tutorial example 75, 94, 148
  workload
    analyze recent 100
hit ratios 21
host variable support 127, 128, 138
hyperlink
  CATALOG
    tutorial example 140, 141
  EXPLAIN 134, 136
  PT 135
  SQLTEXT(EXPLAIN) 84, 138
  to RxD2
    from a trace 136
    from DBIOD 140
    from DBIOR 141
    from DUSER 134, 135
    from SQL statement pop-up 84, 138
    to catalog data 140, 141

I

I/O analysis
  tutorial example
    activity by package/program 92
    activity by page set 92, 117
    activity by plan 92, 118
    activity by SQL statement 93
    asynchronous I/Os 92, 117
    balance table space allocations 30
    cache statistics 29
    collecting I/O events 116
    detail I/O events 93, 116
    detail trace summary 86
    Primary Option Menu selection 116, 117
    printing I/O reports 119
    running a system I/O trace 116
    summarized trace events 92, 93, 117
    synchronous I/Os 92, 117
    system-wide traces 115
    total measurements 117
    volume summary 28
    with data sharing 53
improving performance
  tutorial example 73, 124
index
  DB2 topics 19
index administration
  tutorial example
    access more details 146
    information for one index 146
INPUT mode
  monitor history display
    tutorial example 39
interval
  counts
    tutorial example 10
  default timer request 33
INTERVAL keyword
  Trace Summary by Time display
    tutorial example 106
isolating performance problems 5, 109

J

Journal log
  Enhanced 44
  finding exception messages 110
  viewing a subset of messages
    from current target DB2 44
  warning messages sent to 33

K

key indicators
  STRAC display
    tutorial example 78, 109
  TSTAT display
    tutorial example 91, 110

L

LEVEL keyword
  tutorial example 89
LINECNT keyword 153
LKBWZ view
  tutorial example 25
LKBWZSSI view
  tutorial example 60
LKCONZ view
  tutorial example 25
LKEVENT view
  tutorial example 23
LKEVSSI view
  tutorial example 59
LKRESD view
  tutorial example 24, 60
LKRESNRZ view
  tutorial example 24, 60
LKRESZ view
  tutorial example 24, 59
Local Buffer Pool Statistics Detail view 20
Local Filters panel 114
location
  connecting to remote 134, 142
lock
  analysis
    avoiding expensive traces 87
    detail trace events 87
    detail trace summary 86
    global contention 57
    hot spots in tables 60
    resource information 24, 59
    see plans 60
    timeouts and deadlocks 23, 57
  contention
    global 57
    tutorial example 23, 37
  pop-up
    summary 90, 131
    timeout 90
Lock Wizard Global Members view 58
Lock Wizard Global/Local Contention view 58
Lockout Blocker/Waiter Summary view 25
Lockout Connection Summary view 25
Lockout Events view 23
Lockout Global Blocker Waiter Summary view 60
Lockout Resource Conflict Detail view 24, 60
Lockout Resource Number Summary view 24, 60
Lockout Resource Summary view 24, 59
log
  application transfer
    tutorial example 43, 110
  data sets
    displaying history traces 75
    logging a trace 71
    printing a trace 94, 119, 148
  display
    selecting current target DB2 44
    tutorial example 43
    viewing subsets 44
  keyword
    tutorial example 33
logging
  DB2 messages
    selecting current target DB2 44
    tutorial example 43
    viewing a subset 44
LOGTRAC keyword
  tutorial example 68, 116
long-running threads
  tracing 70, 75
    recommendations 70
LTRAC
  display
    scrolling 77
    tutorial example 77

M

MAINVIEW
  accessing
    tutorial example 6
  Selection Menu
    tutorial example 6
maximum PLOT graph values
  tutorial example 38, 41
maximum warning threshold value
  starting a monitor 33
MAXPAGES keyword 153
messages
  DB2 43
  exception
    displaying 36
    tutorial example 14
  MAINVIEW for DB2 43
  origin identifier 44
  viewing a subset
    from current target DB2 44
MESSAGES option
  tutorial example 36

minimum warning threshold value
starting a monitor 33
MODIFY (M) line command
tutorial example 34
modifying requests
tutorial example 34
monitor
a data sharing group 47
area summary (DMAREAZ) 41
definition 31
tutorial example
defaults 33
graph of warning status 31, 37
history display 38, 41
isolating problems 31
list of active timer requests 31, 37
looking at different workloads 32
modifying 34
multiple requests 31, 32
Primary Option Menu selection 8, 31
replicating 33
resource 32
starting 31, 32, 33
stopping 34
threshold marker 31, 37
windows mode views 40
workload 32
warning summary (DWARN) 40
workload objectives (DOBJ) 42
Monitor Summary by Area view 41
Monitors in Warning view 40
multi-index pop-up
tutorial example 90
multiple
DB2s
tutorial example 9
requests
automatic start 31, 37
MVS console
warning messages sent to 33

N

navigating between traces 76
between threads (STRAC display) 88
NEWPAGE keyword 153

O

objective
workload
monitoring 42
Objectives Review view 42
overview
of all DB2s
tutorial example 10

P

package
overview (STRAC)
tutorial example 81
page set
considerations
with data sharing 53
views
status 26
Page Set Cache view 29
Page Set GBP-DEP Status view 56
Page Set Status view 26, 27
parameters
service request
tutorial example 33
trace request
tutorial example 68, 116
performance
of a bad SQL statement
improving 73, 124
of an existing application
analyzing 73, 124
problems
isolating 5, 109
Performance Reporter
reports 160
PF10/22 (display next entry)
tutorial example 88, 131
PF11/23 (display previous entry)
tutorial example 88, 131
PF5/17 (Log Display REPEAT FIND)
tutorial example 43
PF5/17 (Log Display transfer)
tutorial example 43, 110
PF6/18 (GO)
tutorial example 39
PF7/19 (scroll)
tutorial example
Data Collection Monitor list application 32
DB2 Trace Entries display (LTRAC) 77
Detail Trace Entry display (DTRAC) 89
PF8/20 (scroll)
tutorial example
Data Collection Monitor list application 32
DB2 Trace Entries display (LTRAC) 77
plan
I/O analysis
across data sharing members 60
PLAN administration
tutorial example
access more details 143
information for one plan 142
PLAN keyword
tutorial example 110

PLOT
use
automatic refresh mode 39
exceptions only 39
tutorial example 38, 41
PLOTMAX keyword
tutorial example 33
plus (+)
qualifier
tutorial example 110
point and shoot
tutorial examples
BIND-TEXT pop-up 130
from DBIOD display 140
from DBIOR display 140, 141
from DTRAC display 130, 131
from DUSER display 134, 135
from LTRAC display 77, 91, 92
from SQL statement pop-up 84, 138
from TSTAT display 92
from USERS display 134
to buffer pool activity 80
to database summary 85
to DB2 catalog information 140
to DBIO display 92, 117, 118
to DBIOD display 140
to DBIOP display 118
to DBIOS display 93
to detail entry display (DTRAC) 89, 139
to DTRAC display 130
to DUSER display 134
to elapsed time analysis 79
to EXPLAIN PLAN_TABLE display 134, 135
to EXPLAIN pop-up 131
to lock and I/O events 86
to LOCK-SUMMARY pop-up 131
to package details 81
to sort summary 87
to SQL statement pop-up 84, 90, 138
to SQL statement summary 82, 88, 137
to SQL statement text 84, 138
to STRAC display 77, 109
to TSTAT display 91, 110
pop-up
asterisk (*) indicator 90
BIND TEXT
tutorial example 90, 130
definition vii
EXPLAIN
tutorial example 90, 131
LOCK-SUMMARY
tutorial example 90, 131
LOCK-TMO
tutorial example 90
MULTI-INDEX
tutorial example 90
SQL statement
tutorial example 84, 90, 131, 138
usage 90
Primary Option Menu
tutorial example
access to analyzers, monitors, and traces 8
RxD2 124
printing
reports 147
offline 155
online 148
screens
series of displays 35
single display 35
traces
SQL prototype 132
tutorial example 94, 95, 119, 148, 149
problems
analyze lock and I/O
tutorial example 86
review critical
tutorial example 35
product
line transfer
to DB2 catalog information (RxD2) 140
to other MAINVIEW products 39
to RxD2 124, 133
stacking 39
PROFILE command 44
prototyping
SQL statements 124
print results 132
PSBPGBPZ view
tutorial example 55
PSBPSZ view
tutorial example 30
PSCACHE view
tutorial example 29
PSGBP view
tutorial example 56
PSSTAT view
tutorial example 26, 27
PSVOLPS view
tutorial example 54
PSVOLSSI view
tutorial example 53
PSVOLSZ view
tutorial example 28, 53

Q

QMF
queries 163
qualifier
wild cards
asterisk (*) 110
plus (+) 110
Qualifiers panel 114
quick start
reference card 1

R

RANGES keyword
  tutorial example 33
reference card
  MAINVIEW for DB2 1
refresh
  monitor history display
    tutorial example 39
remote
  catalogs
    accessing 142
  locations
    connecting to 134, 142
REPLICATE (R) line command
  tutorial example 33
report keywords
  tutorial example
    data selection 95, 121, 149
    formatting options 97, 153
    SQL prototype 132
report samples
  printing 147
  tutorial examples 97, 121, 122, 153
report selection
  batch trace print 95, 121, 149
    SQL prototype 132
reports
  Data Collector 160
  from DB2 tables 162
  from SMF 160
RESET USERID command
  authorization
    for tutorial exercises 65
resource
  monitors 32
response time
  objectives
    monitoring 42
reviewing critical problems
  tutorial example 35
reviewing history 16
RFIND command 43
ROLLBACK
  execute SQL 126, 138
RST keyword
  tutorial example 33, 68
RUNNING mode
  monitor history display
    tutorial example 39
RX command 124, 133
RX IX (indexname|OBID)
  command 146
RX PL (planname)
  command 142
RX PT (planname) (owner)
  command 144
RX TB (tablename|OBID)
  command 145
RxD2
  accessing from other products 133
  using with MAINVIEW for DB2 123
    expand from DBIOD 140
    expand from DBIOR 141

S

S line command
  tutorial example
    select a workload monitor 32
scans
  by table space and index space 85
screen
  printing
    series of displays 35
    single display 35
scrolling
  tutorial example
    Data Collection Monitor list application 32
    DB2 Trace Entries display (LTRAC) 77
    Detail Trace Entry display (DTRAC) 89
selection criteria
  for workloads
    starting a monitor 33
SEQ parameter
  navigating between trace entries
    tutorial example 88
service
  objective
    monitoring 42
service-level objective
  workload
    monitoring 42
session
  counts
    tutorial example 10
severity codes
  tutorial example 36
single system image (SSI)
  contexts
    defining 48
    selecting 48
  using
    tutorial example 9
SM application transfer
  tutorial example 31
SORT
  tutorial example
    by average I/O wait time 117
    by maximum I/O wait time 117
    by number of I/Os 118
    by pages scanned 83
    by percent I/O wait time 92, 118
    by user ID 77
    detail trace summary (STRAC) 87
    evaluate impact 87
    lockout events (LKEVENT) 23
    trace log data sets 75
    Trace Summary by Time display 106

SQL
action
COMMIT 126, 138
ROLLBACK 126, 138
execute
tutorial example 126, 138
tutorial example
full text of current statement 13, 134
printing 132
prototyping 124
statement pop-up (DTRAC) 90, 131
statement pop-up (STRAC) 84, 138
statement summary (STRAC) 82, 88, 137
SQL Counts Detail view 17
SQLID
current 127, 134, 138
SSI Context Activity Manager view 48, 51, 52
SSI Context Selection List view 48
SSI Easy Menu 9, 40
ST application transfer
tutorial example 66, 125
START
keyword
default timer request 33
default trace request 68
tutorial example 116
Start DB2 Trace Request
data entry panel 67
Start DB2 Workload Monitor Request
data entry panel 32
start time
default timer request 33
default trace request 68
tutorial example 116
starting
monitors
tutorial example 31, 32
trace
tutorial example 66, 116, 125
status
of all DB2s 9
of current traces 66, 72
of one DB2 16
detail view 16
of thread completion 78
Status Detail - Interval view 16
STDB2 view
tutorial example 10, 16
STDB2D view
tutorial example 16
STEXC view
tutorial example 14
STOP
(Z) line command 34
keyword
default timer request 33
default trace request 68
tutorial example 116
stop time
default timer request 33
default trace request 68
tutorial example 116
stopping
monitors 34
STORAGE keyword
default trace request 68
I/O trace request 116
STRAC
display
tutorial example 78, 109, 150
STRATE view
tutorial example 10
STSQLD view
tutorial example 17
summary trace
authorization ID
tutorial example 110
connection name
tutorial example 110
day
tutorial example 110
location name
tutorial example 110
Summary Trace Entry display
tutorial example
base section 78, 109
buffer pool activity 80
database summary 85
detail event summaries 82
elapsed time 79
lock and I/O events 86
navigate 88
package/DBRM overview 81
sort summary 87
SQL statement pop-up 84, 138
SQL statement summary 82, 88, 137
SYNC parameter
tutorial example 92
syntax
notation vii

T

tab points for expanding
  tutorial examples
    BIND-TEXT pop-up 130
    from DBIOD display 140
    from DBIOR display 140, 141
    from DTRAC display 130, 131
    from DUSER display 134, 135
    from LTRAC display 77, 91, 92
    from SQL statement pop-up 84, 138
    from TSTAT display 92
    from USERS display 134
    to buffer pool activity 80
    to database summary 85
    to DB2 catalog information 140
    to DBIO display 92, 117
    to DBIOD display 140
    to DBIOP display 118
    to DBIOS display 93
    to detail entry display (DTRAC) 89, 139
    to DTRAC display 130
    to DUSER display 134
    to elapsed time analysis 79
    to EXPLAIN PLAN_TABLE display 134, 135
    to EXPLAIN pop-up 131
    to lock and I/O events 86
    to LOCK-SUMMARY pop-up 131
    to package details 81
    to sort summary 87
    to SQL statement pop-up 84, 90, 138
    to SQL statement summary 82, 88, 137
    to SQL statement text 84, 138
    to STRAC display 77, 109
    to TSTAT display 91, 110
table administration
  tutorial example
    access more details 145
    information for one table 145
table space
  allocation
    balancing 30
  catalog display 140
  qualifier panel 141
target
  when hyperlinking to RxD2 134, 142
testing
  an application 73, 124
  an SQL statement 124, 126
  compare results 130
  tips 73, 124
THACINTV report 112
THACLIST report 113
THACQLTV report qualification panel 113
THDACTV view
  tutorial example 12
thread activity
  current 12
    multiple DB2s 14
thread history
  accessing data 100
  data collection 100
Thread History by Hour view 103
Thread History Trace Log List view 100
Thread Interval by Connection Types view 103
Thread Interval Summary History view 101
threshold
  marker 31, 37
    monitor history display 38
  warning message 33, 37
time
  command
    tutorial example 16
  of exception
    locate 43
TIME keyword
  tutorial example 110
title
  defining 68, 116
TITLE keyword
  tutorial example 68, 116
topic index 19
trace
  tutorial example
    accessing EXPLAIN 136
    accessing services 76
    activating 72
    additional options 68
    analyzing DB2 workload 99
    avoiding expensive lock event traces 87
    BIND-TEXT pop-up 130
    buffer pool activity 80
    collecting I/O events 116
    database summary 85
    defaults 67
    detail entry display (DTRAC) 89, 130, 139
    detail event summaries 82
    detail events 70, 116
    elapsed time 79
    error messages 72
    exception filters 69
    EXPLAIN pop-up 131
    history 148
    I/O analysis 92, 115
    improving performance 73, 124
    list of current 66, 75
    list of historical data sets 75, 94, 148
    list of trace entries (LTRAC) 77
    lock and I/O events 86
    LOCK-SUMMARY pop-up 131
    logging 71
    long-running threads 75
    managing log data sets 94, 148
    narrowing 69
    navigating 76, 88
    package/DBRM overview 81
    Primary Option Menu selection 8, 66, 75
    printing 94, 119, 148
    qualifying 68
    sort summary 87

trace *(continued)*
tutorial example *(continued)*
SQL statement pop-up 84, 90, 138
SQL statement summary 82, 88, 137
starting 66, 116, 125
summary by authorization ID 110
summary by connection name 110
summary by DDF location 110
summary by relative day 110
summary entry display (STRAC) 78, 109
summary of all threads (TSTAT) 91, 110
testing applications 73, 124
totals (TSTAT) 91, 110
tuning an application 65, 75
Trace Statistics display
tutorial example
base section 91, 110
trace summary
by authorization ID
tutorial example 110
by connection name
tutorial example 110
by location
tutorial example 110
by relative day
tutorial example 110
TRANSFER command
windows to full-screen mode
tutorial example 18
transferring applications
tutorial examples 33, 35
CT command 125
LOG command 43, 110
SM command 31
ST command 66, 125
to full-screen mode 18
transferring between products
to other MAINVIEW products 39
to RxD2 124, 133
expand from DBIOD 140
expand from DBIOR 141
TRBUFF
Detail Trace Options panel
tutorial example 70
trend
of monitor history values 38, 41
TRSIZE
Detail Trace Options panel
tutorial example 70
TSO id operand
send warning messages to a user 33
TSTAT
display
tutorial example 91, 110
tuning
an application with trace 65, 75
group buffer pools 61
information
tutorial example 55
SQL prototyping 124
print results 132
TYPE
keyword
tutorial example 68, 116

U

user
Detail Status display
tutorial example 12, 134
warning messages sent to 33
UTRAC display
view detail events as they occur
tutorial example 75

V

volume
I/O analysis
tutorial example 28
with data sharing 53
Volume I/O SSI Summary - Session view 53
Volume I/O Summary - Session view 28, 53
Volume Page Sets view 54

W

W marker
graph of warning status 31, 37
monitor history display 38
warning
all monitors 40
automatic 31, 33, 37
message
current list 33
hyperlink 10
to a user 33
to Journal log 33
to the MVS console 33
triggering AutoOPERATOR EXECs 33
tutorial example 14
overview 37
status 31, 37
threshold marker
graph of warning status 31, 37
monitor history display 38
threshold value
starting a monitor 33

WHERE
command
tutorial example 28
WIDTH keyword 153
WIF keyword
tutorial example 33
WIN keyword
tutorial example 33
window
information line
tutorial example 9
wizards
tutorial example
data sharing 54
global lock 57
WLIM keyword
tutorial example 33
WMSG keyword
tutorial example
starting a monitor 33
workload
analysis from MVDB2/DC active trace data sets 112
objectives
monitoring 42
service-level objective
monitoring 42
summaries 101
workload history
analyze
navigate through trace displays 105
recent 100
workload monitors 32
workload selection criteria
starting a monitor 33
WRAP keyword
default trace request 68
WTO (write-to-operator operand)
send messages to MVS console 33
WVAL keyword
tutorial example
starting a monitor 33
WZDSBOPT view
tutorial example 62
WZDSDEP view
tutorial example 54
WZDSGBR view
tutorial example 63
WZDSGBRD view
tutorial example 63
WZDSGBSA view
tutorial example 64
WZDSGMEM view
tutorial example 61
WZLKGCON view
tutorial example 58
WZLKGMEM view
tutorial example 58
WZLKGOPT view
tutorial example 57

X

X ON|OFF command
tutorial example 31, 39

Z

Z line command (STOP)
tutorial example 34

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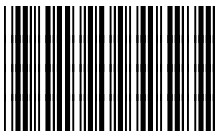

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